THE

AMERICAN JOURNAL

OF THE MEDICAL SCIENCES.

MARCH, 1909.

ORIGINAL ARTICLES.

THE DIETETIC TREATMENT OF DIABETES.

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The treatment of diabetes is far from ideal. We are powerless to influence the carbohydrate metabolism directly. No extracts of pancreas, or of other organs, have yet been found productive of definite good. While drugs have their place in the treatment of symptoms and of complicating conditions, none of them have proved of value in combating the disease itself. With the exception of the alkalies, they are at best accessory to thorough dietetic treatment. Unfortunately they are frequently depended upon to replace the latter, with disastrous results. To prescribe arsenic, as is commonly done, and neglect the details of diet, is like leaving a tuberculous patient in a dark ill-ventilated room, and giving creosote to cure his disease. Both are done, but, in the light of the knowledge easily available today, both are dangerously near criminal negligence. Muscular exercise, in some patients, seems to increase sugar combustion to a limited extent, but seldom in the severe types of diabetes, in which it may have the opposite effect. Indirect measures, aiming at increasing the general well-being, are of value, as in all chronic diseases.

Dietetic treatment is our mainstay. Does it actually influence the progress of the disease? I prefer to turn to the reverse side of that question first. Does neglect of proper dietetic treatment hasten the course of diabetes? Emphatically it does in a large proportion of cases. The evidence of this seems clear, although

absolute proof from controlled experiments is out of the question. If this be true, then our first question is answered affirmatively, since the diabetic must eat, and, therefore, must have either proper or improper dietetic treatment. If his physician does not prescribe the former, he will the latter. Furthermore, it is a commonplace of therapeutics that a weakened function should not be overtaxed. It is, therefore, rational to shield the organs concerned in carbohydrate metabolism from constant demands beyond their damaged powers.

We recognize that diabetes is primarily a disturbance of nutrition, in which the power of utilizing carbohydrates is more or less completely impaired; and that, in the more severe cases, there is added to this, secondarily, a disturbance of the fat combustion (possibly also that of the proteins), which results in the production of certain abnormal organic acids. So far as we now have definite proof, all the effects of diabetes upon the general nutrition are due to these two factors; although so able an observer as von Noorden believes that in some cases a toxic destruction of body tissue will also eventually be demonstrated. This, however, is a matter of minor importance.

Because the diabetic can use only a portion, if any, of the carbohydrate of his food, he loses this amount of potential energy through the urine. From this comes the loss of flesh and strength. A gradual increase in the sugar content of the blood is a constant accompaniment of human diabetes. It is the probable source of many of the complications of the disease, especially of the lowered resistance to bacterial infections. The liability to rapidly advancing tuberculosis, when once the bacillus has found lodgment in the lungs; to spreading gangrene, if an artery is occluded; to dangerous carbuncles from slight skin infection, is well known. The development of arteriosclerosis, or of chronic nephritis, is also probably due in part to the hyperglycemia. Acidosis, on the other hand, is a more direct danger, as the forerunner of coma. It, too, when considerable, entails a not insignificant energy loss for the body, for oxidation, which should go on to water and carbonic acid, stops at the good-sized molecules of β-oxybutyric or diacetic acids.

The problem of the management of the diabetic, therefore, is the problem of nourishing the organism with little or no carbohydrate, and, at the same time, avoiding the danger of acid intoxication which arises when no carbohydrate is being consumed.

The main reason why proper dietetic treatment of this important disease has not been more general in this country has seemed to me largely because, on the one hand, the simple underlying principles have not been clearly set forth in English text-books, and, on the other, because the details of diabetic diets have been planned by German investigators for the German stomach and are quite unsuited to our habits and tastes. My object in writing the present

paper is to endeavor to supply these two deficiencies for the general practitioner. I shall not attempt to discuss the many difficult problems which arise in connection with individual cases of diabetes complicated by other diseases, nor to consider the treatment of coma. Neither shall I discuss special and not universally adopted dietetic regimens, such as von Noorden's oat cure, or Mosse's potato cure, which the interested student may easily look into for himself, if he has a firm grasp on underlying principles and the essential details of practical dietetics in diabetes.

DIAGNOSIS. The first principle in treatment is that it be based on a correct diagnosis. In diabetes this means vastly more than the discovery of sugar in the urine. It means the determination of two points: (1) The degree of impairment of carbohydrate metabolism, or its index, the severity of the glycosuria; and (2) the presence or the degree of secondary disturbance of the metabolism, that is, the severity of the acidosis. It can be made only by a quantitative study of the metabolism in these two particulars by the help of accurate chemical methods. These methods, however, are not beyond the ability of any medical student. To Naunyn and to von Noorden and their pupils do we owe this clear conception of the basis for all our dietetic treatment of the disease.

I. *Estimation of the Carbohydrate Tolerance.* I will first consider the severity of the glycosuria; I prefer to say the determination of the carbohydrate tolerance of the patient. The method is simple. The patient is placed upon an accurate test diet of ample fuel value; that is, containing at least 35 large calories per kilogram of body weight, but made up practically wholly of protein and fat. Such a standard diet, suited to American habits, is shown in Table I.

One will note at once the very considerable amount of fat which it contains. This is of prime importance in the management of the diabetic's domestic economy, the reason being obvious, as we shall see later.

To this test diet is added a weighed amount of white bread Naunyn uses milk, but in my experience bread is far more acceptable to the patients. If the patient when first seen has been upon a liberal diet and has considerable glycosuria, it is unwise to pass at once to a strict fat-protein diet, because in some cases extreme acidosis and coma have been precipitated by such sudden transition. In these cases one allows three ounces (90 grams) of white bread at the start. In the milder cases, particularly if they have been moderately dieted before one has seen them, I usually order the strict test diet at once in order to save time. Whichever method is employed in the individual case, the bread allowance is reduced until the urine becomes sugar-free, or until the patient has been for at least a week on the strict test diet without losing his glycosuria. Such cases fall into the class of the more severe diabetes; those who lose their glycosuria upon the exclusion or reduction of the carbohydrates are of

the milder type. In further study, these two groups must be sharply separated. For the milder cases, bread in weighed amounts is then added to the test diet, a portion being given with each meal, until sugar reappears. In this way the tolerance for starch in the form of white bread, which contains on the average about 55 per cent. of starch, is determined, and the patient's tolerance is expressed as equivalent to two or three or more ounces of white bread, as the case may be. (See Case I.)

For severe cases, which do not become sugar-free after complete exclusion of the carbohydrates, a reduction of the protein intake must next be made. It has been clearly shown, first by Naunyn, and by all subsequent students, that glycosuria is markedly increased by a large consumption of protein. (See Case II.) Such a test diet, with restricted protein, is given in Table II.

The aim should be to have not more than 14 grams of nitrogen a day appear in the urine. If, on such a diet, the glycosuria disappears, the case may be called, following von Noorden, one of moderately severe diabetes. If it persist in spite of protein restriction and complete exclusion of carbohydrates, it is of severe type. In dealing with the two latter classes it is essential that tests for the acetone bodies should be made frequently, and, if present in any amount, that considerable sodium bicarbonate, one-fourth to one ounce a day, should be given during the whole period.

For ordinary clinical purposes one of the simple fermentation tests for dextrose is a sufficient quantitative method. For those who can afford it, the polariscope is the most convenient accurate means of determining the sugar, readings being made before and after fermentation, and the difference being taken as the sugar percentage. The titration methods are time consuming and unnecessary in ordinary practice.

For the mild cases which tolerate more than three ounces of white bread, a further study of the qualitative tolerance—that is, of the utilization of different forms of starch—may be made, oatmeal, rye bread, potato, rice, barley, or other carbohydrate foods being used in starch-equivalent amount to suit the individual taste. Table IV shows these equivalent amounts. Some diabetics show a distinct divergence in their reaction to different forms of starch. For figures on all food materials, Atwater and Bryant's[1] tables may be consulted.

II. *Determination of the Degree of Acidosis.* As is well known, if a normal individual is suddenly deprived of carbohydrate food, acetone and diacetic acid appear in his urine in considerable amounts, and even β-oxybutyric acid may be found. After a few days he be-

[1] Bulletin No. 28, revised edition, The Chemical Composition of American Food Materials, Corrected to April 14, 1906. Can be secured through the Superintendent of Documents, Government Printing Office, Washington, price 5 cents in currency, not stamps. Also see Joslin and Goodall, Boston Med. and Surg. Jour., 1908, clviii, 248.

CASE I.—Mild Diabetes. Age, fifty-four years.

Date.	Amount 24 hrs. c.c.	Specific gravity.	Sugar 24 hrs. grms.	Acetone, Legal's.	Diacetic, Gerhard's.	Weight.	Diet.
1907. II, 22	3360	1031	163.—	tr.	0	177½	Much gluten bread and mush, milk, oysters, apple.
III, 4	2650	1016	15.9	tr.	0	175¼	Strict + 1 apple (but tasted sweets day before).
11	2000	1020	0	+ +	tr.	176	Strict.
25	1500	1026	15.—	+ +	tr.	176½	+3 oz. bread.
IV, 8	1600	1018	0	0	0	176½	+2 oz. bread.

CASE II.—Moderately Severe, Progressing to Severe Diabetes. Age, thirty-one years.

Date.	Amount 24 hrs. c.c.	Specific gravity.	Sugar 24 hrs. grms.	Acetone.	Diacetic acid.	NH_3.	N.	Weight.	Diet.	Medication.
1906. VII, 25	3900	1010	0	– –	– –	– –		– –	+4 oz. toast, 1 potato, ½ oz. oatmeal, 1 orange. 1 tablespoon peas	None.
X, 30	....	1021	Trace	Tr.	– –	– –		163	+ 2 oz. toast, ½ oz. crackers, 1 orange.	"
1907. I, 7	1530	1027	16.8	0	0	– –		165¾	+½ oz. toast, 2 crackers, 1 orange.	"
21	1560	1031	39.—	+	tr.	– –		165¾	+1 oz. oatmeal, 1 oz. crackers.	"
28	2000	1026	12.—	+ +	tr.	0.81		162½	Standard.	"
II, 18	1700	1025	18.7	+ +	+	– –		165½	Standard + Casoid biscuit.	"
III, 7	1680	1027	6.7	tr.	0	– –		171½	+ 3 oz. oatmeal, 1 oz. corn bread, 5 oz. baked potato.	No work. Hard exercise.
IV, 25	1400	1026	5.6	+ +	+	0.03		171½	Standard.	Soda ½ oz.
VII, 19	1230	1027	0	0	0	0.92		160¼	Restricted protein.	None.
X, 11	2280	1032	70.6	+ + +	+ +	– –		164½	+1 oz. oatmeal. High protein, after summer vacation.	"
22	2245	1035	56.1	+ + +	+ +	1.02		164¾	Strict, but much meat.	Soda ¼ oz.
31	1380	1030	11.4	+ + +	+	0.42	17.6	167½	Strict, with restricted protein.	"
XI, 6	1290	1027	6.4	+ +	+ +	1.48		167¼	Strict, with restricted protein. Cream 3 oz.	" "
1908. I, 1	1960	1027	35.3	0.72 gm	2.12 gm	2.42	15.79	164	Strict, with restricted protein. Cream 4½ oz.	" "
10	1800	1027	9.8	0.58	1.75	1.28	16.29	167¾	Strict, with restricted protein. Cream 3 oz.	" "
31	1540	1021	0	+	+	0.56	10.01	166¼	Hunger day.	" "

comes accommodated, as it were, to the altered conditions of his body chemistry and the β-oxybutyric and diacetic acids disappear, while the acetone sinks to the mere trace present in normal urine. Through the work especially of Geelmuyden, Magnus-Levy, and L. Schwarz, it has been made clear that diacetc acid and acetone are derived in this order from β-oxybutyric acid, which is the mother substance of these bodies, and that their appearance and that of the unchanged mother substance represents an abnormal type of metabolism of the fatty acids, which occurs when too little carbohydrate is being burned within the organism. Now in severe diabetes we have a permanent condition in which little or no carbohydrate is being oxidized, no matter how much of it may be consumed; in diabetes, therefore, the acetone bodies attain a peculiar significance. It is not possible to relate them quantitatively with the carbohydrate tolerance, save that the patients who can utilize three ounces or more of bread do not show acidosis. Below this point they may or may not be present. In some severe cases they always are. They should be tested for, in diabetic urine, as regularly as it is examined for sugar. For acetone I would recommend the use of Legal's test; for diacetic acid, the simple ferric chloride test of Gerhardt, controlled by Arnold's, which is less subject to confusion by other substances. These tests may be found in the ordinary text-books of clinical laboratory methods. Tests for β-oxybutyric acid are all complicated, but its presence may be inferred if a urine which contains acetone and diacetic acid is found to be levorotary after complete fermentation.

The quantitative estimation of the acetone bodies is not possible as a routine procedure outside of well-equipped laboratories.[2] One most important means of estimation of the severity of acidosis remains, however, an indirect method. It is the determination of the ammonia content of the urine. By Folin's recent method, which involves very simple procedures and is applicable by anyone who can afford a suction pump on a water faucet, ammonia can be quantitatively determined, and gives us much information of the amount of abnormal acids which are thus calling forth the manufacture of this basic radicle by the organism, to save it from complete loss of its fixed alkali. When alkali is given therapeutically it combines with a portion of the acids, and the ammonia excretion may fall sharply, while the acid excretion is unchanged or even increased. Under these circumstances its determination alone is no guide to the intensity of the acidosis.

III. *General Examination of the Patient.* Having thus dwelt upon the special features of diagnosis in diabetes, it must not be inferred that aught of the ordinary routine of clinical examination may be neglected. The general condition of the patient and his

[2] A simple method for approximating the excretion of acetone bodies is given by T. Stuart Hart, Arch. Int. Med., 1908, i, 218.

CASE III.—Very Severe Diabetes. Age, thirty-four years.

Date.	Amount 24 hrs. c.c.	Specific gravity.	Sugar 24 hrs. grms.	Acetone, Legal's.	Diacetic, Gerhardt's.	NH_3.	Weight.	Diet.	Medication.
1907. III, 22	3500	1033	238.0	+ + +	+ +	2.95	111½	+5 oz. gluten toast, oatmeal, potato, fruit, etc.	Arsenic.
28	2840	1030	102.2	+ +	+ +	2.95	114	Standard + 3 oz. bread, 1 orange, 2 apples.	Soda ½ oz.
IV, 2	2400	1028	52.8	+ + +	+ + +	2.70	117	Standard + 3 casoid biscuit.	" 1 oz.
13	2700	1026	43.2	+ + +	+ +	0.65	- -	Standard + 1 casoid biscuit.	" 1 oz.
15	2100	1020	10.5	+ + +	+ +	0.49	115	2 green days, + 3 eggs, cream, bacon, oil, cheese.	" ½ oz.
V, 4	1700	1036	71.4	+ + +	+ +	0.44	117¾	Standard + 2 oz. bread, ½ grape fruit.	" ½ oz.
29	2100	1031	39.9	+ +	+ +	0.74	121¾	Standard + casoid biscuit.	" ½ oz.
VI, 25	1600	1031	27.2	+ +	+ +	1.06	120	Standard, no cream.	" ½ oz.
VII, 1	2560	1013	trace	tr.	0	0.54	- -	2 green days, no cream.	" ½ oz.
12	1650	1025	37.9	+	+	1.34	120	Standard, + 1 oz. bread, cream 2 oz.	" ¼ oz.
VIII, 10	2970	1029	88.2	+ + +	+ + +	3.18	112½	Excessive meat. At hotel.	" ½ oz.
X, 8	3045	1029	191.8	+ + +	+ + +	4.31	- -	2 oatmeal days after 2 green days.	" ½ oz.
15	3240	1030	110.1	+ + +	+ + +	4.12	113½	Standard restricted protein + 2 oz. bread, 1 apple.	" ½ oz.
IX, 10	3240	1028	133.1	+ + +	+ + +	4.87	109	Eating little.	" 1 oz.
25. Died in coma.									

weight must be carefully noted. The tongue should be inspected, and the odor of the breath perceived. Heart and vessels, lungs, digestive organs, kidneys, skin, nervous reactions, eyes, all should be systematically examined, with the complications of the disease always in mind. Pulmonary tuberculosis, serious nephritis, or other grave co-existing maladies, as well as extreme inanition with threatened coma, demand individual study of a more complex therapeutic problem, and will be excluded from present consideration.

Classification of the Case. Having determined the degree of impairment of carbohydrate metabolism, and the degree of acidosis in a given patient, it is convenient for purposes of treatment to assign him to a category. It must be clearly held in mind, though, that all categories are artificial; also that they are insufficient for prognosis. A young person with mild diabetes is unlikely to live so long as an old man with much more severe glycosuria, for clinical experience has demonstrated that the disease in the first instance will almost surely be progressive. We must be prepared to reclassify our cases as we observe them. Fortunately we may, with a proper diet therapy, have the great satisfaction of seeing the tolerance of some patients improve. (See Case IV.)

For clinical purposes, Naunyn's[3] criterion of the mild form of the disease I would strongly urge. It is the ability to take a not irrelevant amount of bread, two ounces (60 grams) or more, without producing glycosuria. Von Noorden classifies from the same standpoint. Practically, diabetics who are restricted to a less amount of bread than this have as great temptation to exceed their tolerance as those in whom starch is wholly interdicted. In addition, the amount which can be allowed is an insignificant fraction of the normal carbohydrate content of a mixed diet, and without real value in the attempt to maintain normal nutrition.

Individuals with a tolerance below this point, but who become sugar-free on a diet without carbohydrate, I consider moderately severe cases, following von Noorden's[4] usage. Those who, in addition to exclusion of carbohydrates, require restriction of their protein intake to rid the urine of sugar, are severe cases. The most severe types show glycosuria on a restricted protein diet, or a constant marked acidosis in addition to severe glycosuria. Mandel and Lusk[5] have called attention to the occurrence of total carbohydrate intolerance, with dextrose appearing in the urine on a protein-fat diet in the same proportion as in complete phloridzin glycosuria, D : N : : 3.65 : 1. Von Noorden reports even higher figures. Where absolute control of the diet and exact sugar and nitrogen determinations are possible, this ratio deserves further study. I would warn,

[3] Der Diabetes Mellitus, second edition, Vienna, 1906, p. 185.
[4] Diabetes Mellitus, New York, E. B. Treat & Co., p. 177.
[5] Deut. Arch. f. klin. Med., 1904, lxxxi, 472.

CASE IV.—Mild Diabetes ♥ Age, fifty-two years.

Date.	Amount 24 hrs. c.c.	Specific gravity.	Sugar 24 hrs. grms.	Acetone.	Diacetic acid.	Weight.	Diet.
1903. VII, 20	2040	1017	40.8	– –	– –	133	Supposed strict, but 8 oz. gluten bread, 1 quart milk, little fat.
VIII, 13	1310	1020	0	– –	– –	132	Strict 4 days.
24	1060	1026	2.5			135¼	+ 4 oz. bread.
1904. IV, 14	1500	1010	1.8	+	0	– –	+ 1 oz. bread, 1 oz. oatmeal, 1 apple.
XI, 28	1200	1030	22.0	– –	– –	140	+ 2 oz. toast, 6 oz. potato, 3 apples (against orders).
1905. I, 9	1350	1017	11.47	– –	0	139¾	+ 4 oz. bread, 1 orange.
IV, 24	1380	1017	0	– –	0	137	+ 3 oz. bread, 1 orange, following 4 days strict.
VIII, 30	1530	1018	0	– –	0	– –	+ 5 oz. bread, 6 oz. potato, 1 orange.
XI, 3	1080	1025	4.36	– –	0	– –	+ 7 oz. bread or equivalent.
1906. II, 27	900	1029	5.4	0	0	– –	+ 3 oz. bread. 3 apples (against orders).
III, 21	900	1022	0	+	0	138	Strict.
V, 10	1170	1020	0	0	0	– –	+ 5 oz. bread.
X, 10	900	1022	2.7	+ +	0	– –	+ 6 oz. bread, some fruit.
1907. I, 5	1260	1020	0	+	tr.	– –	Strict + ½ grape fruit.
25	1400	1017	1.4	+	0	– –	+ 3 oz. bread, 1 orange.
II, 21	1900	1012	0	tr.	0	137	+ 3 oz. bread, 1 orange.
V, 8	1440	1016	2.88	0	0	– –	+ 5 oz. bread.
VI, 6	1700	1009	0	tr.	0	– –	+ 3 oz. bread.
X, 31	1320	1016	6.6	0	0	137	+ 7 oz. bread.
1908. I, 21	1680	1012	0	tr.	0	– –	+ 3 oz. bread, following 2 days strict.

however, against the acceptance of figures from any diet containing cream, since I have learned that some diabetics show marked intolerance of even the minimal amount of lactose and of the casein in the heaviest centrifugal cream; also that lactose is not the sole carbohydrate present in commercial cream.

TREATMENT. We are now prepared to take up the therapeutic problem as it presents itself in these different stages of the disease. We shall succeed best, I think, if we conceive the problem as the maintenance of adequate nutrition in the diabetic individual, in such manner as to prevent or minimize, first, hyperglycemia, and, second, acidosis.

I. *The Maintenance of Nutrition.* The normal adult provides from 1500 to 2000 calories of his daily energy requirement in the form of carbohydrates. For the diabetic almost all of this is lost; he must, therefore, be nourished on protein and fat. A glance at Case III, when she first came under treatment, will show that, with a very moderate consumption of carbohydrates, 238 grams of sugar, representing about 950 calories (1 gram = 4.1 calories), was wholly lost to the organism. Even in mild cases the tolerance for starch is seldom great enough for us to count on it for more than a fraction of the needed energy.

Ruebner[6] has shown that, with increase in protein consumption, there is increase in the total metabolism, therefore, of the energy requirement. He names this the specific dynamic action of protein. On this account it is unwise to feed more than a moderately increased amount of protein, say 150 grams a day. Since the caloric value of protein is 4.1, we can at best provide 600 calories in this way, leaving about 2000 for the average man to be taken in the form of fat.

How can this be contrived? The test diets which I give herewith contain about 2000 calories in fat (1 gram = 9.3 calories), and one will note that butter, thick cream, bacon, oil, and cheese figure largely. The first three are foods of the utmost importance for the diabetic. One may also take pains to select the fatter meats and fish, pork, fat beef, and mutton, and salmon, for instance. In this way there is no great difficulty in introducing the necessary amount of fat into the diet.

A somewhat greater difficulty arises in having it eaten. Fat food is not agreeable to many persons, and in some cases causes digestive disturbances and diarrhœa. As a help in fat digestion alcohol is of distinct value, and it is next to impossible to give the large amounts of fat necessary in diabetes, without wine or spirits being taken at the same meal. Whisky or brandy, Rhine or Moselle wine, claret or Burgundy, may all be used, but sweet wines are of course prohibited. The amount should not exceed an alcohol content of 40 grams in the day. As alcohol has a fuel value of 7

[6] See Lusk, Science of Nutrition, Philadelphia, 1906, p. 135. This book should be consulted by every physician who is unfamiliar with the fundamental principles of nutrition and scientific dietetics.

calories per gram, it is in itself not to be despised as an additional source of energy in these cases.

Case IV has been to me an instructive example of the need for alcohol in the diabetic dietary. Being a Methodist clergyman, he objected seriously to having it known that he took whisky, and would always abandon its use every few months. Each time he did an attack of fatty diarrhœa made him speedily resume it.

In the more serious types of diabetes, the problem of securing adequate nutrition is further complicated by the necessity for considerably restricting the protein intake, even to below the normal figures, because of the effect on the glycosuria. Here we must use great care in the calculation of the energy equivalent of the food given, or malnutrition will speedily result. Even this problem, however, is perfectly solvable, and one may keep patients for considerable periods on diets containing 80 grams of protein or less. Case II shows clearly the benefits of such a method.

In hospital practice the greatest obstacle to a proper diabetic dietary is the expense of the best fat-containing foods, cream being practically prohibited. It is much harder to provide variety, so that the patients tire of their food, and with loss of appetite there is loss of strength as well. Under such unfortunate conditions one may be obliged to depart somewhat from the best methods of treatment in order to preserve his patient alive.

I would insist strongly upon the need for attention to even the smallest detail in the arrangement of diets, and the encouragement of patients as well to work out the greatest variety possible to them within the limitations prescribed. One must always remember that, in calculating the energy value of any diet, the calories lost in the form of sugar excreted should always be subtracted.

II. *The Control of Hyperglycemia.* In every case of diabetes our aim should be to free the urine from sugar; that is, to prevent hyperglycemia. This may not always be possible, and it may at times be necessary to abandon the aim temporarily. But the physician will succeed best who keeps this as his main objective in the treatment of diabetes. With increasing experience he will find it increasingly possible of attainment.

The two chief obstacles are psychical, not physical. They are laziness or ignorance on the part of the physician, and self-indulgence on the part of the patient. In no chronic disease is coöperation between patient and physician more essential than in diabetes. When we demand of a patient a life of the most irksome watchfulness and self-restraint, he is at the least entitled to a reasonable explanation of the why and wherefore. This we must be able to give him simply and convincingly. Without this ability to enlist his help, all effort at treatment is likely to be futile.

Certain general directions may be laid down for all cases. Sugar and sweets in every form must be permanently interdicted. It is also important that patients should be taught to avoid often unsus-

pected sources of starch, such as sauces, gravies, and soups thickened with flour. It is well that they should be provided with a list of the foods which are allowed and of those which are forbidden, and should be quizzed on these until sure of their ground (Table III). Excessive water drinking is unwise. I need not say that all matters of daily hygiene should be inquired into and regulated.

More specific dietetic directions will depend upon the classification of the case. In the mild forms, with a tolerance for two ounces or more of bread, it is essential that the carbohydrate tolerance be never exceeded. Many physicians and patients are satisfied if the percentage of sugar in the urine remains small. This is to invite future trouble. When a diabetic who can tolerate three ounces of bread shows glycosuria, it is prima facie evidence against either his physician or himself.

A period of strict diet should initiate treatment in all cases. Following this it is well to limit the consumption of starchy foods to not more than three-quarters of the tolerated amount, with occasional periods of strict diet, and yearly or half-yearly determinations of the tolerance anew.

These milder cases may be allowed to choose the form in which they will take their allotted portion of carbohydrate, if provided with some simple table of equivalents, such as Table IV. It is well, however, to make a few tests to guard against the idiosyncrasy to certain forms of starch which some patients show. The very mild cases, in older people, may have one of the vegetables or fruits from Table V each day.

Von Noorden's[7] plan of arranging the diet in periods is immensely helpful, and I should advise physicians to familiarize themselves with its details, which may be found in his Herter lectures on Diabetes.

In the moderately severe cases, by careful study of the effect of restricted protein, one may prevent glycosuria over considerable periods, or reduce it to a minimum. In this class the interposition of one or two days of very low diet containing but little protein is of great value. Naunyn gives mainly broths, and calls them "hunger days;" von Noorden gives green vegetables, with a few eggs, a little fat, as bacon and butter, black coffee, and alcohol in some form, and calls them "green days." As a rule, patients prefer the latter, since they are less conscious of the starvation. The principle is the same. Cases II and III both show the striking effect of such days upon glycosuria. Table VI gives a simple "green diet."

In the severest cases the prevention of glycosuria is manifestly impossible, since it is still present on a carbohydrate-free diet, even after restriction of the protein. The management of these cases requires experience and individual study, and does not lend itself to any brief presentation. I am convinced that even in them much can be done to prolong life by a well-conceived dietetic treatment.

[7] Diabetes Mellitus, New York, E. B. Treat & Co., p. 177.

Case III seemed on the verge of coma when I saw her. The physician who had last had her had ordered considerable carbohydrate food for fear of this occurrence, and she grew rapidly worse. You will see from the chart how glycosuria was decreased, acidosis diminished, and weight at the same time increased, with stringent dietetic treatment. I have had a number of similar experiences.

III. *The Prevention of Acidosis.* These more severe cases present a double problem. Acidosis, which occurs during carbohydrate starvation in the normal individual, assumes much more serious proportions in the diabetic. When present it should be watched during treatment as carefully as the glycosuria. The milder grades diminish spontaneously after the first few days of strict diet, and need occasion no alarm. When the ammonia output, however, rises to 2, 3, or more grams a day, and a strong ferric-chloride reaction is constantly present in the urine, one must proceed cautiously with prolonged periods of strict diet, and must especially avoid sudden changes in the carbohydrate content of the food. Considerable amounts of alkali, one-half to one ounce of sodium bicarbonate, must be given daily in these cases. A portion of this may be replaced by sodium citrate if desired.

Shall we in any given case abandon the attempt to minimize the glycosuria because of an existing acidosis? This is the difficult question which arises in all severe cases. I can only express my opinion, which grows stronger with every successive case of this type that I handle, that the attempt to overcome the acidosis by allowing much carbohydrate, almost always fails of its purpose. With severe grades of diabetes this carbohydrate does not enter into the metabolic processes of the organism, and, therefore, is without value in aiding the proper oxidation of the fatty acids, merely adding hyperglycemia, with resultant polyuria and thirst, to the trouble already existing. In such cases permanent restriction of the protein is of the greatest value, and occasional "green" or "hunger" days are essential. It is not yet clear which of the fats cause the highest production of oxybutyric acid, and I do not think that we are in a position to draw any practical guidance from the experiments thus far made, save that it is perhaps wise that butter for such patients should be freed from contained butyric acid by thorough washing. For help in the management of this difficult combination I must refer those interested to Naunyn's and von Noorden's books.

IV. *Diabetic Foods.* Every reader has probably noted a conspicuous omission from the dietetic measures I have recommended, namely, gluten bread. From my experience I say, without hesitation, that gluten bread is the diabetic's worst enemy. Taught by the dealer, or, worse yet, by the physician, not only that it is safe for him to eat, but sometimes even that it is actually a cure for the disease, he eats it in large quantities.

If one would know what gluten breads usually are, he should

examine the most instructive analyses of diabetic foods made by Winton.[8] They are one of the great frauds of the age. The best gluten breads contain over 30 per cent. of starch; the worst, such as the Jireh products, much more than ordinary white bread. The only preparations of this type available in this country which contain under 10 per cent. of carbohydrate are the gluten foods made by Herman Barker, Summerville, Massachusetts; the Soja bean meal of the Theodore Metcalf Company, of Boston; and the casoid flour and biscuit of Callard, Stewart, and Watt, Limited, of London. The large casein content of the last is objectionable, since casein increases glycosuria more than any other protein.

At the best, even these are a very small help in providing something to eat more butter on, and fulfil no real function. It is better to allow the carbohydrate one does give in the form of familiar and longed-for foods, such as white bread, the starch content of which is well known.

In concluding, I trust that I have persuaded some that the intelligent treatment of mild diabetes is possible to any practitioner of medicine, and is of immense importance. Just as in tuberculosis we have learned that early diagnosis and treatment offer our main hope, so in other chronic diseases, of which diabetes is an excellent example, may we, by the prompt institution of thoroughgoing dietetic treatment immediately upon the discovery of its first indications, hope to prevent the development of the more severe and intractable forms of the disease. Increasingly early diagnoses, and increasing power to control the chronic diseases in their incipiency, will distinguish the medicine of the future, and we have the making of that future in our hands.

TABLE I.—Standard Strict Diet.

Breakfast:

Coffee with 1½ ounces cream.
2 eggs cooked with ½ ounce butter.
3 ounces ham.

Luncheon:

Bouillon with 1 raw egg.
3 ounces sirloin steak, chicken, or leg of lamb.
1 ounce bacon.
Vegetable from list, 2 tablespoonfuls, with ½ ounce butter.
Dessert made with 1 egg and 1½ ounces cream.[9]
6 ounces wine, or 1 ounce whisky or brandy.

Afternoon tea with ½ ounce cream.

[8] Report of the Connecticut Agricultural Experiment Station, 1906, p. 153.

[9] The following recipes for desserts are suggested:

Baked custard: One egg, 1½ ounces of cream, 2½ ounces of water; two or three ½-grain saccharine tablets, 8 drops of vanilla essence. Beat up well, pour into a buttered dish, grate a little nutmeg on top, and bake twenty minutes.

Coffee ice-cream: 1½ ounces of cream, 1½ ounces of water, 1 ounce of strong coffee, two or three ½-grain saccharine tablets. Dissolve. Add one egg, well beaten. Mix in a saucepan and beat slowly with stirring until it thickens. Set aside until cool; then freeze.

Dinner:

Any clear soup.
3 ounces fish (salmon, shad, or mackerel), with ½ ounce butter.
¼ pound roast pork, beef, mutton, turkey, or lamb chops.
Vegetables from list, 2 tablespoonfuls, with ½ ounce butter.
Salad with ½ ounce oil in dressing.
1 ounce cheese, English, pineapple, Swiss, or full cream.
6 ounces wine, or 1 ounce whisky or brandy.
Demitasse of coffee.

Protein	= 126 grams;	515 calories
Fat	= 222 grams;	2065 calories
Carbohydrate	= 15 grams;	60 calories
Alcohol	= 30 grams;	210 calories
		2850

Vegetables Allowed.

Asparagus, beet greens, Brussells sprouts, cabbage, cauliflower, celery, chicory, cresses, cucumbers, egg plant, endive, lettuce, mushrooms, radishes, rhubarb, salsify, spinach, string-beans, tomatoes, vegetable marrow.

Table II.—Standard Diet with Restricted Protein.

Breakfast:

Coffee with 1½ ounces cream.
2 eggs with ½ ounce butter.
1 ounce bacon.

Luncheon:

2 eggs.
1 ounce bacon.
2 ounces lamb chops (1), ham (2), beefsteak (3), chicken (4), or fish (5) broiled with ½ ounce butter. (Each day select meat with same number for luncheon and dinner.)
Vegetable from list, 2 tablespoonfuls, with ½ ounce butter.
Dessert made with 1 egg and 1½ ounces cream.
6 ounces wine or 1 ounce whisky or brandy.

Afternoon tea with ½ ounce cream.

Dinner:

Any clear soup.
¼ pound roast pork (5), beef (4), mutton (3), turkey (2), chicken (1), or lamb (1). (Each day select meat with same number for luncheon and dinner.)
Vegetables from list, 2 tablespoonfuls, with ½ ounce butter.
Salad with ½ ounce oil in dressing.
1 ounce cream cheese.
6 ounces wine or 1 ounce whisky or brandy.
Demitasse of coffee.

Protein	= 82 grams;	334 calories
Fat	= 215 grams;	2008 calories
Carbohydrate	= 15 grams;	60 calories
Alcohol	= 30 grams;	210 calories
		2612

Table III.—General Diet List.

Eat no sugar or made dishes containing sugar, no starchy foods, such as bread of any kind, cereals, potato, rice, peas, dried beans or macaroni, soups or sauces thickened with flour, and no milk.

Try to eat every day much butter, bacon, oil on salad, and cheese, especially cream cheese.

A small amount of cream (up to 4 ounces a day) may be taken in coffee and tea. Saccharine, ½ grain, may be used for sweetening.

Whisky with water, or a light Rhine wine or claret, may be drunk with dinner and supper.

Foods Allowed.

Clear meat soups.

All meats except liver.

Eggs in any form.

All fish except oysters, clams or scallops.

As desserts, jellies, or custards, or ice-cream, made with cream and eggs, and sweetened with saccharine, and flavored with vanilla, coffee, or brandy.

Cream, cheese, and the following vegetables: Asparagus, beet greens, Brussells sprouts, cabbage, cauliflower, celery, chicory, cresses, cucumbers, egg plant, endive, lettuce, mushrooms, radishes, rhubarb, salsify, spinach, stringbeans, tomatoes, vegetable marrow.

Table IV.—Table of Equivalents.

Article.	Per cent. carbohydrates.	Amount in ounces equal to 1 ounce white bread.
Breads:		
White	51–55	1
All other	47–53	1
Rolls and biscuit	52–60	1
Cornbread	46	1⅛
Crackers, average	69–72	¾
Cereals:		
Oatmeal, boiled	11.3	5
Hominy, boiled	17.8	3
Macaroni, boiled	15.8	3¼
Rice, boiled	24.4	2⅛
Tubers and Legumes:		
Potatoes, cooked	18–20	3
Parsnips	13	4
Beans, baked	20	2¾
Beans, lima, cooked	20	2¾
Peas, green, cooked	15	3½
Milk	4–5	10
Fruits:		
Apples, apricots, and pears	12–14	4
Cherries	15	3½
Huckleberries	16	3¼
Plums	20	2½
Bananas	22	2½
Nuts:		
Filberts	12	4½
Almonds	15	3½
Peanuts	22	2½

Table V.—For Mild Cases.

List of vegetables and fruits with less than 12 per cent. carbohydrates: 3 ounces of any one of these may be taken daily.

Vegetables 5 to 10 per cent.:

Onions, squash, turnips, okra, carrots.

Fruits below 12 per cent.:

Lemons, watermelons, strawberries, gooseberries, muskmelons, cranberries, blackberries, currants, grapefruit, oranges, raspberries, sour apples.

Nuts:

Butternuts, hickorynuts, walnuts.

TABLE VI.—Green Days.

Breakfast:
1 egg, boiled or poached.
Cup of black coffee.

Dinner:
Spinach with a hard-boiled egg.
½ ounce bacon.
Salad, with ½ ounce oil.
6 ounces of wine or 1 ounce of whisky or brandy.

4.30 P.M.:
Cup of beef tea or chicken broth.

Supper:
1 egg, scrambled, with tomato and a little butter.
½ ounce bacon.
Cabbage, sauerkraut, string-beans, or asparagus.
Cup of tea.

½ ounce of sodium bicarbonate in the twenty-four hours.

CARDIAC DANGERS IN HIGH ALTITUDES.

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THE dangers to the heart in high altitudes are, I believe, precisely the same as elsewhere, but very sharply exaggerated in certain directions. The most frequent and serious of these troubles are found in connection with myocarditis, arteriosclerosis, and dilatation of the heart.

Leaving the physiology involved aside for the present, we may fairly assume that the heart and lungs have to meet increased demands with each added degree of elevation and its consequent decrease in atmospheric pressure. Common experience will teach one this, even though he knows nothing of physics. To meet the increased circulatory demand the heart must hypertrophy if one is to take his usual exercise.

The robust miners who work at 10,000 or 12,000 feet elevation have a cardiac area extending to the nipple line, in spite of their more voluminous lungs, for increased lung capacity is equally necessary in their work. It is found that the Virginia deer has less heart weight in proportion to body weight than our own blacktail deer, yet the latter, when fat in the fall, can hardly run a half mile, when high in the mountains, without becoming almost exhausted, as I can testify from personal knowledge.

It is not strange, then, that we see frequently cases of acute dilata-

tion after comparatively slight effort in those whose arteries have begun to harden, and who have been accustomed for perhaps fifty years to a sea-level pressure. There are at least three contributory factors to be noted: those coming to the mountains are frequently professional men and others equally "out of training," who still wish to climb a mountain on the day of their arrival; the bracing air gives them a sensation of increased physical and mental vigor, so that they feel like undertaking a big feat, and are led into undertaking too much of a feat; and I have known repeatedly of trouble indirectly from climatic conditions, which, being new and strange, were the cause of overexposure or overexertion.

Thus I have seen recently a man, aged sixty-seven years, who walked three miles on a fine day and failed to meet his friend, with whom he expected to ride back; a heavy head wind meanwhile arose and in trying to walk against it, his heart gave out, he fell to the ground, became chilled, contracted pneumonia, and now lies at the point of death. Many a patient walks in the foothills or mountains until beginning fatigue warns him to return. Before reaching home he is utterly exhausted; and the physician finds him with a widely dilated heart and a mitral leakage.

One patient had been a hunter and trapper in the Rocky Mountains until fifty years of age, when he purchased a ranch in the Arkansas Valley at an elevation of only 3000 to 4000 feet. Seven years later some friends visited him from the East and he took them up Long's Peak, over 14,000 feet in altitude. He suffered greatly from palpitation and dyspnœa, but his grit being better than his judgment he continued until he dropped from exhaustion. When he started he was a hale looking ranchman of fifty-seven years, with no suggestion of heart disease; when I saw him a few days later with Dr. Spivak his heart was greatly dilated, the mitral valve leaked, and there was general dropsy. Death resulted in a few days. The death of Dr. Nicholas Senn is stated in the medical press to have resulted from just such overstrain in the high altitudes of the mountains of La Paz, in South America.

The unseasonable and unexpected fall of snow has, in a similar manner, in some of my patients, occasionally demanded more effort than was anticipated, in getting back to camp or hotel, with resulting overstrain of the heart. Any of these troubles might have developed elsewhere, but the means for rapidly exhausting the strength of an ill-nourished heart muscle seem to be less easily attainable at sea level than here.

In those with but a narrow margin of heart strength the increased work of heart and lungs, as they ascend in a railway train, may bring trouble. A Pullman conductor who had run for many years over the highest point of the Union Pacific Railway, told me that he had had eight deaths occur in travellers upon his cars as they neared the high point of the route. Presumably most of these were from

causes allied to those I am discussing. Several such have fallen under my notice.

I have the impression that attacks of angina pectoris in those disposed to the disease, are more easily provoked here than in the East. This may be because I have known of two or three patients who had the attacks upon very slight exertion or excitement; but my experience with this disease elsewhere is so limited that I hesitate to more than mention this belief.

Without statistics to prove it I am equally impressed with the belief that atheromatous patients with increased blood pressure are more liable to disaster than those without such increase. The failure by even a small margin to maintain the required pressure disturbs the circulatory conditions profoundly.

I have just sent East a woman, aged forty-three years, who presented premature senility and marked arteriosclerosis, with an increase of 50 per cent. in her blood pressure. She complained within a few days of arrival that a walk of a mile had exhausted her so that she barely reached her hotel, and especially that her legs were so tired as to be painful, though they recovered after a short rest. She had never had such symptoms before. Her heart was dilated, the mitral valve leaked, and the feet were cold. No arterial pulsation could be found in either foot. The intermittent lameness here had as its base the usual arteriosclerosis, but the exhaustion of a feeble heart muscle, insufficiently supplied with blood, and called upon for increased work because of the unaccustomed altitude brought the trouble to an immediate crisis. I do not doubt that her blood pressure was still higher before her overexertion here, and its fall with the acute dilatation of the heart would account for the sudden development of the symptoms.

Patients with extreme mitral stenosis, whose hearts are suddenly called upon for greatly increased work, are in grave danger anywhere, but especially so here. I have seen three deaths in young patients within the first seventy-two hours in acute pneumonia under these conditions: in one within thirty hours from the initial chill; a fourth escaped by the narrowest margin, the pneumonia aborting at the end of forty-eight hours after Dr. Rover and I believed that death was imminent.

Very moderate exertion in young man whose mitral orifice was extremely narrowed, as we learned at the postmortem examination, brought on pulmonary œdema, with expectoration of enormous quantities of pink serum, and death in three hours. A similar case with presystolic murmur and thrill, seen with Dr. H. B. Whitney, was saved by prompt and copious venesection.

Patients with hearts greatly exhausted by chronic disease, as in phthisis, pernicious anemia and similar troubles, are occasionally seriously embarrassed by the increased demands of the altitude, even though no physical exertion be made. I have seen cases

of advanced tuberculosis in which, upon arrival here, this heart weakness, together with the greatly diminished lung area, caused acute suffering, demanding immediate return to a more favorable elevation. This may be advised the more readily because no possible climatic advantages can be of any service to such patients. The atrophic heart of wasting disease, the decreased lung area, the anemia, the general weakness, the exertion of coughing, and the mental anxiety, are all doubtless contributory factors.

In fairly compensated valvular lesions I have seen death follow a sudden break in the compensation from a single severe overexertion. The same factors which operate upon the arteriosclerotic heart are active also in these cases, as well as the greater demands which given work makes upon this organ, the liability to overexertion because of the stimulating climate, etc. A typical example is that of a boy, aged eighteen years, with well-compensated aortic regurgitation following rheumatism. He was quite an athlete in the early days of wheel riding, and rode one day with this club to a point twenty miles away in the foothills. This he did quite easily, but it evidently was all that he should have done that day. On returning in the afternoon he found that a stiff head wind had arisen, and with all the exertion he could make he was not able to keep up with his companions. He went to bed on reaching Denver, and presented, when I examined him, a greatly dilated heart, mitral regurgitation, general anasarca, albuminuria, and all the signs of imminent death from acute cardiac failure. His death was reported to me by his physician a few days later.

A long experience here convinces me, however, that the average case of well-compensated valvular disease does as well here as anywhere else. The relative infrequency of acute rheumatism as compared with some harsher climates, is advantageous. Those acclimated and well accustomed to the seasonal and topographical peculiarities of a mountainous region, are not so likely to fall into the errors I have noted as newcomers would be.

Patients with valvular disease, but with well-nourished heart muscle and fair arteries, may, almost regardless of age, I believe, go to reasonably high altitudes with safety, if only they follow the rule I have long laid down for my cardiac patients, namely, to make no exertion which causes any considerable dyspnœa. After any failure of compensation occurs it is better to avoid the increased demands involved.

THROMBOSIS OF THE INFERIOR VENA CAVA.

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THE value of reports of unusual cases lies, first, in the clinical interest and attention aroused by anything out of the ordinary, and, second, in the educational value of this attention if it is pursued to a logical conclusion. A report of two cases of thrombosis of the inferior vena cava, therefore, should prove of some interest, particularly if it includes a study of the manifold clinical manifestations of the condition. This communication concerns two such cases, Case I being acute and possibly a sequel of influenza, and Case II being chronic, the diagnosis being made possible by the collateral circulation.

CASE I.—A man, aged twenty-six years, single, a clothing salesman by occupation. His personal history is uneventful, with the exception of typhoid fever four years previously, from which he made a good recovery. He has noticed a gradual gain in weight the past few months. Two weeks before the onset of the present illness the patient was confined to his bed a few days with influenza, but after three or four days he was able to be about and returned to work. He felt well for a week, but at the end of this time, while lifting a heavy case of dry goods, he was seized with a severe pain in the right side. On examination his physician found his abdomen tender, with some ascites, and diagnosticated probable cirrhosis of the liver.

When seen by E. R. S., five days later, the man seemed desperately ill; his face was drawn, anxious, and very pale, but he was able to talk intelligently with a very weak voice. On examination he appeared to be rather well-built and muscular. His heart and lungs were negative. There was no fever. The abdomen was enormously distended, tense, symmetrical, and tympanitic on percussion, with slight tenderness. The liver and splenic dulness were not demonstrable. No fluid in the abdominal cavity could be discovered on account of the tympanites. The legs and external genitalia were much swollen, œdematous, and cyanosed, but not tender or painful, except for the tenseness and tightness due to the œdema. The history of the swelling was that it had come on gradually since the onset of his illness. Rectal examination was negative. The bowels moved regularly. The urine on examination was free from albumin, and in other respects negative.

The appearance of the abdomen suggested an intestinal obstruc-

tion or paresis with tympanites, due to some subacute inflammatory exudate in the pelvis obstructing the iliac veins, or a possible neoplasm or a tuberculous peritonitis.

An exploratory operation was advised, but was refused. At this time the superficial veins were not noticeably prominent. The patient lived about three weeks and died of exhaustion.

The autopsy, made twelve hours ofter death, revealed the following important findings:

The lungs were negative, with the exception of a few adhesions at the left apex and a few small infarcts. The heart was normal. The legs and genitals were swollen and œdematous, but no distended veins were noticeable on the legs or abdomen. The left arm was also œdematous and swollen up to the mid portion of the humerus. On opening the abdomen the abdominal fat was found atrophied and the abdominal wall was 1 cm. in thickness. A large amount of embalming fluid, somewhat blood-stained, escaped. There were no adhesions between the coils of intestines and the parietal peritoneum. The spleen was much enlarged and very hard. The liver measured 25 x 20 x 10 cm.; the surface was smooth. The left lobe was much larger than the right, measuring 12 x 15, while the right measured 17 x 12 cm. The left lobe occupied almost the position normally occupied by the right, that is, the midline. The right lobe was pushed to the right and turned backward, bringing the gall-bladder well under the costal margin in the axillary line. The consistency of the liver was normal, and on section there was considerable passive congestion. The gall-bladder, œsophagus, stomach, pancreas, and adrenals were normal. The inferior vena cava, found to the right of the aorta, was widely dilated, thrombosed, and solid; on section it was found to contain a partially organized blood clot, which extended downward into both common iliac veins and upward to the groove in the posterior surface of the liver, where, near the upper surface of the liver, it ended. The walls were much thickened, fused together, and firmly adherent; the lumen was obliterated. The vessel above that was collapsed and empty. The hepatic and renal veins were also blocked by thrombi continuous with that in the vena cava. The portal system was not obstructed. The anatomical diagnosis was: Œdema of both legs and left arm; dilatation of the superficial veins above the costal margin; œdema of the genitals; thrombosis of the inferior vena cava, renal, and hepatic veins; ascites; multiple infarction of the left lung; adhesive pleuritis of the left apex; chronic passive congestion of the spleen and liver; rotation of the liver to the right and enlargement of the left lobe; peptic ulcer of the duodenum.

On reconsideration of the case two possible causes of the thrombosis are prominent: (1) Influenza may have been the primary cause, and the thrombosis may have been due to a secondary

influenzal thrombophlebitis with extension into the inferior vena cava. This disease is not infrequently associated with thrombosis. Leyden and Guttman have collected twenty-eight cases of thrombosis of the large veins occurring in the epidemic of 1889 and 1890, and thrombosis of the smaller veins is quite common in the disease. On the other hand, the strain of lifting may have caused the tilting over to the right of the liver, causing a twist of the vena cava which mechanically caused a thrombosis. If so this case is unique, the only case approaching it being one reported by Jobert,[1] in which a soldier, after a severe and exhausting march, was suddenly seized with swelling of both legs and the abdomen. He improved after four weeks, but five years later showed the development of a collateral circulation typical for thrombosis of the inferior vena cava.

CASE II.—E. W., aged forty-two years, unmarried, an orderly. The chief complaint was swelling and ulceration of the legs. The patient has never been seriously ill. He denies venereal infection. There has been no history of digestive disorders or disturbances of the central nervous system. He has never been short of breath and there has been no swelling of the feet or ankles. The urinary functions have been normal. He states that from twenty-one years of age he was employed as a bartender and used alcohol to excess, and at that time was using tobacco freely, smoking ten to fifteen cigars daily. Coincident with this overindulgence in alcohol he began to have attacks of chills and fever, lasting two or three days. At first these attacks occurred once a year, but later with greater frequency, until finally they came once in three weeks.

The present illness began in 1893. The onset was sudden, with a severe pain in the calf of the left leg, sharp and sticking in character. The patient was in apparent good health at the time and was sitting in a chair at rest. The pain was so great he was unable to bear his weight on the foot and went to bed. On the following morning the leg was still very painful and greatly swollen as far as the knee. The second morning on arising, the right leg was affected in a similar way; the pain, however, was not localized, but affected the whole leg, which began to swell immediately. The swelling began in the toes and extended upward, until at the end of ten days the whole leg was swollen. The leg became black at first, but gradually the natural color returned. About three weeks afterward an attack of pleurisy suddenly developed on the left side, which, with the swelling in the legs, kept him in bed three months. At the end of this time ulcers formed on both legs and have been present ever since, almost healing at times and then breaking down again. His general condition, however, has slowly improved, and he has been able to be up and about and to do light work.

The attacks of chills and fever have been more frequent since the

[1] Gaz. hebd., 1871, viii.

onset of his present illness. During these attacks the temperature rises to 102° or 103°, and is accompanied by a shaking chill, headache, and nausea. The attack is generally over in twenty-four hours. On March 26 the patient fell while walking, and strained his left side in the loin. Shortly after this the legs increased in size and he began to have a septic temperature, with daily elevations of 102° to 103°. He is at present confined to his bed.

The patient is a stout well-built man, pale, and anemic. The heart and lungs are normal. The arteries are not thickened. The lower border of the liver is not palpable, but on percussion the dulness extends 10 cm. below the costal margin in the mammary line. The spleen is not palpable, and by percussion does not appear to be enlarged. The abdomen is symmetrical and slightly distended, but no masses can be felt. The superficial veins are distended on the left side, being tortuous, elevated above the surface, and easily palpable (Figs. 1 and 2). The veins are also enlarged in the left groin and extend upward, and, gradually diminishing in size, communicate with the terminal branches of the internal mammary vein. When compressed they fill from below. The deep epigastric and superficial circumflex iliac veins form a compensatory circulation with the deep epigastric and lumbar veins above. The veins on the right side of the abdomen are also dilated, but to a lesser degree. They can be distinctly seen running tortuously beneath the skin, but are not easily palpable. It is impossible to determine whether the veins are dilated in the right groin or not, due to the great swelling and induration of the leg.

The left leg is swollen to the level of the knee, the skin is tense, and on palpation the tissues are indurated and hard. In the middle portion of the leg are scars of former ulcers, and an ulcer of small dimensions is there now. The right leg is swollen to the level of Poupart's ligament and is about twice its normal size. The skin is tense and firm, and there has been a proliferation of the connective tissue, giving rise to a condition of elephantiasis. Below the knee there is an ulcer discharging a purulent material and scars of former ulcers. At Poupart's ligament is a deep depression, the result of an operation to relieve pressure on the femoral vein, which it was supposed might be the cause of the obstruction to the venous return flow.

The scrotum and penis are not swollen, and rectal examination shows no masses or anything which could cause obstruction to the return of the venous blood from the legs. Hemorrhoids are present, but give no symptoms.

A blood culture, made during one of the attacks of chills and fever, remained sterile. Repeated examinations of the blood for malarial parasites were negative.

In this case the important points are that the patient, in apparently good health, suffered a sudden stoppage of the veins of the

left leg below the knee, and on the second day following a stoppage of the veins of his right leg. This caused both legs to swell: the left to the knee, the right to the groin. Subsequently a condition of elephantiasis developed with crural ulcers, and later the veins on the left side of the abdomen became dilated and tortuous.

FIG. 1

FIG. 2

Case II, showing the collateral circulation on the right side and front of the abdomen, with elephantiasis of the right leg to the groin and of the left leg to the knee.

It is fairly clear that the obstruction in the left leg was due to a thrombus. Whether this thrombus, by extension through the iliac vein into the lower vena cava, obstructed the right common iliac vein, or whether two distinct thrombi formed, one in each leg, is an open question. We are inclined to believe this latter supposition is the correct one, in view of the fact that the compensatory circulation

on the left side did not develop at once, but gradually. Assuming that at the outset there was a thrombus on both sides, in the popliteal on the left and the femoral on the right, we believe that the thrombus extended upward until at the present time it obstructs the lower part of the inferior vena cava, since otherwise there is no explanation for the establishment of the compensatory circulation between the left deep epigastric and internal mammary veins, between the hemorrhoidal veins and the portal circulation, and between the deep epigastric, lumbar, ascending lumbar, and azygos veins. The thrombus has not yet reached the level of the right spermatic vein, which empties into the inferior vena cava below the renal vein, and which, if obstructed, would cause a swelling of the scrotum.

The attack of pleurisy which occurred three weeks after the onset of the present illness can be explained by assuming that a small portion of the clot became dislodged and led to infarction of the lung, with a slight exudation on the pleural surface. The periodical attacks of chills and fever are more difficult of explanation, but, so far as can be determined, they must be due to a general infection, with periods of latency. The source and nature of the infection we have not been able to determine.

On perusal of the literature of thrombosis of the inferior vena cava, we find that the condition is not common. Krauss,[2] in 1894, was able to collect 102 authentic cases, and Welch[3] says there are more than 140 cases on record. On the other hand, the condition appears to be not uncommon in statistics of large hospitals; presumably most of the cases receive no attention in periodic literature.

Thrombosis of bloodvessels is primarily associated with a combination of circumstances, in which three conditions stand out prominently: (1) Changes in the chemistry of the blood. These are rather indefinite and refer to certain changes in the composition of the blood, either in proteins, fibrin ferment, or antiferment, whereby the blood is made more coagulable. (2) Mechanical factors, in which a weak heart muscle and sluggish circulation play the most important part. (3) Most important of all, some injury or degenerative change in the endothelium of the bloodvessels which determines the formation of a coagulum at this point. This injury may be mechanical or may be due to the action of bacteria or their toxins. In thrombosis of the inferior vena cava the thrombus is rarely autochthonic, but usually reaches the vena cava by extension from the femoral or pelvic veins through the iliac veins, or it is associated with intra-abdominal growth. In Krause's series of 89 cases, in which the cause of the association of the thrombosis was investigated, he found: 25 cases in which the thrombus was associated with malignant growths within the abdomen; 11 cases

[2] Ueber Verschluss der Vena cava superior und der Vena cava inferior. Tübingen, 1894.

[3] Allbutt's System of Medicine, vi, 217.

belonged to the group of marantic thrombi; 8 cases were caused by compression from without; 8 cases were traumatic; 8 cases were associated with puerperal conditions; 7 cases were secondary to phlegmasia alba dolens, ulcus cruris, etc.; 7 were cases of organized thrombosis, mostly marantic; 4 were cases of compression occlusion without thrombosis; and 9 were cases of thrombophlebitis. Malignant growths of the abdomen furnish the largest number of cases. The greater proportion of these affect the inferior vena cava by direct extension into the tissues about the vein, and 80 per cent. perforate directly into it. The primary situation of the growth is apparently of little consequence in determining the likelihood of thrombosis. Carcinoma of the kidney furnishes the largest number of cases; uterine cancer, cancer of the testes, of the liver, of the penis, or new-growths of the retroperitoneal tissues furnish examples of extension into the vein. One case of primary sarcoma of the vein is on record and one case of endothelioma.

The group of marantic thrombi is interesting. The name was first applied by Virchow to the thromboses commonly associated with anemic and cachectic states, and was supposed to be due to sluggish circulation, as well as to certain ill-defined changes in the blood. This view, however, has undergone some revision, since recent studies have shown that many of these so-called marantic thrombi contain the microörganisms of the primary disease with which they are associated. Many of them, therefore, should be classed with the group of infective phlebitis. Phthisis furnishes the largest number of instances of complicating thrombosis of the inferior vena cava, while typhoid fever, erysipelas, cancer of the stomach, influenza, and pneumonia may be the primary diseases.

Compression of the vena cava from without may cause occlusion of the vessel with or without the formation of a thrombus. It is of interest to note in this connection that in one case a pregnant uterus, in one a uterine fibroid, and in one case an ovarian cyst was the primary cause. Retroperitoneal growths, aneurysm of the abdominal aorta, syphilis of the liver, and hypertrophy of the head of the pancreas have all caused such pressure occlusion.

Thrombophlebitis of the inferior vena cava occurred but nine times. One case was caused by perforation of the vein by a needle that had been swallowed and migrated until it penetrated the vein; one case was caused by an extension upward from a thrombophlebitis of the uterine veins caused by a pessary; one case followed a urethral blenorrhœa.

Reviewing, then, the etiology, we find that thrombosis of the inferior vena cava is usually associated with malignant growths of the abdomen, with certain infectious diseases, with septic conditions, and with trauma.

Symptoms. In considering the symptoms of the thromboses, we can conveniently divide the cases into three varieties: (1) Cases in

marantic and cachectic individuals in whom autopsy reveals an antemortem thrombosis of the inferior vena cava, but in whom there were no symptoms during life to call attention to the condition. (2) Cases of partial thrombosis, or of very slowly developing thrombosis. In this interesting group fall those cases of thrombosis of the vena cava in which no symptoms reveal themselves; and it is not until the establishment of the collateral circulation or autopsy that the diagnosis can be made. The most famous case in this second group is that of Quincke,[3] in which, postmortem, the vena cava was found obliterated. During life there was no cyanosis, no œdema of the legs or abdomen, no dilated superficial veins in evidence, and even at the autopsy no definite collateral circulation could be demonstrated. Another interesting case was reported by Warred,[4] in which the inferior vena cava was congenitally thrombosed. Betz[5] reported the case of a male, aged twenty-one years, suddenly dead of acute abdominal disorder, in which the inferior vena cava was found thrombosed with the establishment of a compensatory collateral circulation. The occlusion of the vein was considered to have been congenital. (3) In the third group fall the greater number of cases in which definite evidence of obstruction is present and in which the diagnosis can be made with reasonable confidence. As early as 1840 Rennart, and in 1860 B. Cohn, endeavored by experimental occlusion of the inferior vena cava in dogs to study the effect of such occlusions on the circulation. Their results, however, were so inconstant and inconclusive that the experiments were abandoned. We must, then, be satisfied with the studies of case reports and make allowances for the variations and inconsistencies of the symptoms.

Pain is a rather constant symptom. Its location, as well as the severity varies. Since the circulatory effect of the thrombosis is first manifested in the legs, pain in the legs is most frequently noted; next in order of frequency in the lower abdomen. On the other hand, some patients complain of no particular pain, except the soreness and tenseness due to the œdema and distention. A. Robin regarded pain in the lumbar region with prostration and tenderness about the navel as rather characteristic of thrombosis of the inferior vena cava. On the whole, pain is of little value in the diagnosis. It was mentioned occurring in the legs fifteen times, and in the abdomen sixteen times in Krause's series.

Objectively the most important symptom is œdema of the legs, genitalia, etc., in the region drained by the inferior vena cava. The development of this œdema depends upon the suddenness and degree of closure of the vein, the facility with which the collateral circulation is established, and the condition of the circulatory system

[3] Von Ziemssen's Handbook, vol. vi.
[4] Dublin Medical Journal, lxxv, 36.
[5] Virchow-Kirsch, Jahresbericht, 1877.

of the patient. The œdema is usually bilateral. Schlesinger,[6] on the contrary, was able to collect out of 120 cases 18 in which the swelling was principally one-sided, but in which an autopsy revealed complete closure of the inferior vena cava. The only explanation of this one-sided œdema is either a particularly rich and competent collateral venous circulation, or a possible previous disease of the iliac veins with the previous establishment of a partial collateral circulation. On the other hand, œdema of the legs is not invariably present, as in the case reported by Bresler,[7] who thought that the non-appearance of the œdema was due to the very gradual closure of the vena cava with the rapid development of a competent collateral circulation without the œdema. The œdema extends from the legs and genitals to the abdominal wall, and may in extreme cases extend to the arms, breast, face, etc. General hydrops has been observed five times, and hydrothorax twelve times. Ascites is a rather frequent accompaniment of the condition, depending largely upon the height of the thrombus and the amount of congestion of the viscera. It occurred twenty times in Krause's series. Cyanosis may accompany the œdema, depending upon the rapidity of the occlusion. It was noted by Krause eight times, but seems generally to be considered one of the most constant symptoms of the disease. It occurs particularly in the legs.

Fever is usually present, but depends rather on the primary disease, or on complications, than on the thrombosis. A few cases are on record, however, in which the fever could be explained by the thrombosis. Robin reported a case from the study of which he concluded that a sudden high rise in temperature is rather characteristic of the thrombosis. Fever was specifically mentioned but twenty-eight times in Krause's series.

On the part of the intra-abdominal organs, objective examination reveals rather varied results. The liver may or may not be enlarged. The spleen was enlarged fourteen times. Diarrhœa occurred eighteen times, while constipation was mentioned seven times. Bloody stools occurred once. Albuminuria, regarded by Raymond as constant in thrombosis of the inferior vena cava, occurred but eight times in Krause's series and was absent in the present case. It appears that even when the renal vein is occluded the occurrence of albumin in the urine is not constant.

The most important objective symptom, and the one without which the diagnosis can never be reasonably made, is the evidence of the establishment of the collateral circulation. This means that the venous blood must reach the right auricle by means of the superior instead of the inferior vena cava. There appears to be no general rule that Nature follows to bring this about. Much depends

[6] Zur Diagnostik der Erkrankungen der Vena cava inferior. Deut. med. Woch., 1896, xxii, 460–461.

[7] Deut. med. Woch., 1897, xxiii, 179.

upon the thrombosis and such accidental and congenital disposition of the smaller branches of the veins as most easily to facilitate the conveyance of the blood from one system to the other. The main channels through which this is brought about is by way of the superficial epigastric and superficial circumflex iliac branches of the femoral below, and the long thoracic, a branch of the axillary, in front, and some anastomosing branches of the lumbovertebralis behind. A general idea of the appearance of the collateral circulation may be gained from the photograph of Case II of the present report.

It is self-evident that the prognosis of these cases is necessarily grave and depends on the primary disease with which it is associated. All the cancer cases (25 per cent.) die. Of the marantic thrombi group, nearly all die, associated, as they are, with unusually severe antecedent disease. In the other group, the mortality depends entirely upon the general condition and resistance of the patient and the facility with which the collateral circulation is established. A complication to be feared is pulmonary embolism. The duration of the disease is roughly one or two months. On the other hand, some patients do recover. Bresler reported a case with recovery after typhoid fever. Thompson[8] reported a case that died on the fifty-ninth day. Jobert reported a case that was alive four years after the onset of thrombosis, while Bates reported a case of congenital thrombosis of the inferior vena cava that lived twenty-one years; so that recovery does occasionally occur, although so rarely as to be almost accidental.

COMPLETE AURICULOVENTRICULAR DISSOCIATION WITHOUT SYNCOPAL OR EPILEPTIFORM ATTACKS.

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(From the Laboratories of the Jefferson Medical College Hospital, Philadelphia.)

The earliest recorded observation that I could find of what we may believe was an instance of auriculoventricular dissociation is contained in a paper by Mayo[1] (1838). In this paper is described the case of a man, aged fifty-two years, who suffered from attacks of vertigo and epileptiform seizures and who had a very slow pulse (21 to 34). Mayo noticed that there was a time "when two imperfect actions of the ventricles could be heard between stronger ones which alone were attended with a pulse at the wrist." The next observation is found in Stokes'[2] well-known paper (1846). His patient had a slow pulse (28 to 40) and was afflicted with apoplecti-

[8] Trans. Clin. Soc., vol. viii.
[1] London Med. Gaz., 1838, xxii, 232.
[2] Dublin Quart. Jour. Med. Sci, 1846, ii, 73.

form attacks which were not followed by paralysis. In this case there were pulsations in the right jugular vein, and Stokes noted that these pulsations were more than twice as frequent as "the manifest ventricular contractions."

Cases of the same character were recorded by Blondeau[3] in his thesis (1879). Chauveau,[4] in 1885, made the first graphic records of the movements of the heart in auriculoventricular dissociation. It was not until after a number of years had elapsed, and His[5] had reported his case of "heart-block" (1899), that interest in the matter was awakened. From experimental knowledge he inferred that the condition, as found in man, might be due, among other possible causes, to injury to the bundle of muscle fibers which connects auricles to ventricles. This bundle was described by Paladino[6] in 1876, and subsequently by Stanley Kent,[7] His[8] and others.

All of the above instances of heart-block are cases which presented during life the symptom-complex named by Huchard[9] "Adams-Stokes disease," in honor of the two Dublin physicians whom he credited with the original descriptions of the affection. Cases of permanently slow pulse in which certain nervous phenomena appear, such as recurring attacks of vertigo, syncope, and epileptiform or apoplectiform seizures, are found much earlier in the literature. Two typical cases are described at length in Morgagni's[10] "De sedibus

[3] Thèse de Paris, 1879.

[4] De la dissociation du rythme auriculaire et du rythme ventriculaire. Rev. de méd., 1885, 161 (Figuet's case).

[5] Deut. Arch. f. klin. med, 1899, lxiv, 316.

[6] Berl. klin. Woch., 1908, xlv, 861.

[7] Jour. phys., 1893, xiv, 233.

[8] Wien. med. Blätter, 1894, xvii, 653; Centralbl. f. Physiol., 1895–96, ix, 469.

[9] Traité clinique des maladies du cœur et de l'aorte. Paris, 1899, 3è éd., i, 395.

[10] Morgagni, J. B. De sedibus et causis morborum, etc., Venitiis, 1761. Book I, Letter IX, Art. 7. Ad quod ut redeam; perstringam paucis, quantum potero, quæ multa ac diu in cive meo Anastasio Poggio, gravi, proboque Sacerdote animadverti. Agebat is annum duodeseptuagesimum, subpingui habitu, et florido colore, præditus, cum primum comitiali morbo correptus est, qui summam pulsuum raritatem, itemque corporis perfrigerationem post se reliquit. Sed hæc intra horas septem victa est, nec, sæpius redeunte morbo, amplius rediit: illa usque perstitit. Prima epilepsia dolori successerat hypochondrii dexteri, per biliosas dejectiones soluto: cæteræ, quæ leviores erant, fere succedebant sensui cujusdam quasi fumi ad caput ascendentis ex hypochondriis quorum turgentia assidue ægro molesta erat, et facile ab assumptis, liquidis præfertim, augebatur.

Letter LXIV, Art. 5.

Mercator erat Pativii annos natus quatuor et sexaginta, quadrata statura, et obeso, non tamen nimium, corporis habitu. Is olim rheumati, et nervorum contractionibus cum esset obnoxius, Medicis auxiliis sanatus fuerat, ut quamvis pluribus, variis que negotiis assidue distineretur, valeret tamen ad eam usque ætatem quæ modo indicata est cum improviso ea acciderunt, unde vehementissimis animi affectibus terrore, timore, iraque deinde, et mœstitia corripiretur. Paucis post hæc diebus, quadam ingruente quasi vertigine, cecidit. Postridie autem motibus convulsivis cum insultu, epileptici simili, vexari cœpit. Is erat brevis, sed frequens, et ructibus fœtidis erumpentibus solvebatur, subsequente faciei interdum rubore, interdum pallore, sensu autem augustiæ faucium, et ventriculi perpetuo gravis. Erant pulsus eo tempore validi quidem, sed duri, et rari: alvus autem, et vesica perpauca redebant.

. . . Hæc menses perstitit circiter quatuor donec post brevem ambulationem, et scalarum ascendum, priores illi convulsivi insultus, rariores tamen, et breviores, invadere iterum cœperunt, et pulsuum raritatem reducere. Mensis tum erat December. A quo tempore usque ad Junii initium cum morbus vinci non posset, tunc ego consulendi causa accersitus, et ea quæ tibi hactenus descripsi, audivi, et ægrum qualem ex memorata Epistola cognoscere potes, inveni. Raritas præcipue pulsuum illa tanta, ut eorum numerus duabis circiter tertiis partibus minor esset quam oporteret, cum inculcabatur, tum a me quoque reperiebatur.

et causis morborum" (1761). The first one is recorded in Book I, Letter IX, Art. 7; the case is that of a "worthy priest of moderately fat habit and florid complexion, who in his sixty-eighth year was attacked by epilepsy, which left behind it the greatest slowness of pulse and in like manner a coldness of the body." The second case is found in Letter LXIV, Art. 5; the patient, who was sixty-four years old, had repeated attacks of vertigo and epileptiform convulsions, with "pulse two-thirds less than its natural frequency." I have also found another early description of the so-called Adams-Stokes syndrome, in a paper by Spens[11] (1792).

Since His' report progress in the study of heart-block has been rapid. The experiments of Humblet,[12] Hering,[13] and Erlanger[14] on the mammalian heart have been so often recounted that they have become common knowledge. The anatomical data concerning the auriculoventricular connecting bundle of muscle fibers (the bundle of His) have been completed by Tawara,[15] Fahr,[16] and others. Finally, a number of well-studied cases of heart-block occurring in man under various pathological conditions is on record. In some instances the clinical and, incidentally, the experimental findings were controlled by a postmortem examination of the organs which experiment has shown are susceptible of being incriminated.

Complete auriculoventricular dissociation is not of frequent occurrence, although it is possible that a systematic examination of every case of slow pulse by graphic methods or by radioscopy may somewhat raise its incidence. It is then partly on account of the comparative rarity of this affection and the associated desire to add to our knowledge of it, and partly because of certain uncommon features of the case, that the following clinical study is reported:

The patient, M. M., is a woman, aged thirty-five years, single, white, and a hosiery mender by occupation. Her father died at the age of forty-one years of tuberculosis. The mother is living, aged sixty-seven years, and in good health; she has on the left side of the face, in the neighborhood of the parotid gland, a hard growth the size of a large egg. One brother is living, aged forty years. He is said to be suffering from "kidney trouble."

The patient had measles and mumps during childhood. She states that she has been suffering from indigestion for the past fifteen years. Menstruation began at the age of fourteen; the menses are regular but painful. The pain begins two or three days before and persists

[11] Med. Comment., 1792, Edinb., 1793, decade 2, vii, 458

[12] Arch. intern. d. phys., 1904, i, 278.

[13] Arch f. d. ges. Phys., 1905, cvii, 97; ibid., 1905, cviii, 267.

[14] Jour. Exper. Med., 1905, vi, 676; 1906, viii, 8.

[15] Das Reizleitungssystem des Säugetierherzens. Eine anatomisch-histologische Studie uber das Atrioventricularbündel und die Purkinjeschen Fäden. Jena, 1906, G. Fischer, 209 pp.

[16] Münch. med. Woch., 1907, liv, 636; Virchow's Arch., 1907, clxxxviii, 562.

during and sometimes for a few days after the cessation of the flow. Menstruation lasts one week, and is usually profuse. She gave birth thirteen years ago to a healthy child at full term. The pregnancy and puerperium were uneventful; she states, however, that her health has not been good since that time. No information concerning the subsequent health of the child is obtainable, owing to the fact that she kept it only three days. She has had a leukorrheal discharge for ten years. She also has a uterine displacement, for which she has been wearing a ring pessary during the past three years. Definite evidence pointing toward syphilitic infection could not be obtained.

The patient first applied for treatment on June 27, 1908, at which time a tracing was taken, to which reference will be made later. She was admitted to the wards on July 7, 1908, in the service of Prof. H. A. Hare, to whom I am indebted for the privilege of reporting the case. I wish here also to express my indebtedness to Dr. J. C. DaCosta, Jr., and Dr. F. J. Kalteyer for the use of clinical notes they were kind enough to make.

Present Illness. (July 7, 1908.) The patient began nine months ago (October, 1907) to suffer from pain in the back, indigestion, and bearing down sensations in the pelvis. She went to a physician, who told her that she had an ovarian cyst, and advised operation. Previous to reaching this decision, he examined her heart and pronounced it in good condition. She, however, refused her consent to an operation; the physician then prescribed for her, giving her a liquid medicine (drops) and pills. The patient claims that the first of these medicaments made her worse. In a week she was short of breath, had pain in the abdomen followed by diarrhœa; she also had flushes of heat and numbness of the extremities. While working in the mill she had, in the pelvis, a peculiar sensation which she describes as "pulling," but which was unattended by pain; at the same time she had palpitation of the heart. Her shortness of breath became intensified and developed into orthopnœa. She stayed in bed at that time for two days, and, according to her own statement, has not been able to work since. She then complained of aching in the limbs and of more or less generalized pain; she also began to have creeping sensations throughout the body. The patient then consulted another physician, who advised exercise in the open air. The walking, however, induced precordial and substernal pain and a "giving way" sensation in the region of the heart. She also experienced now for the first time the feeling of a lump in the throat. She then went to a third physician (about April, 1908), who first spoke of her slow heart action.

The patient at the present time shows no evidence of dyspnœa, and, while not feeling very strong, is quite able to go about. She is of a diffident and rather pessimistic disposition. She denies having ever fainted or having had convulsions, and inquiry from her mother and intimate friends confirms this statement.

Examination. The patient is fairly well developed, of medium height, and in a poor state of nutrition.

The apex beat is visible and palpable in the left fifth intercostal space in the midclavicular line. There is with each heart beat a distinct heaving of the left side of the chest anteriorly, most marked near the sternum. At a point above and to the inner side of the apex light impulses may be felt in the periods between two systoles. These light impulses vary from two to three, and do not always occupy the same relative position in diastole. Now and again the apex beat is more forcible. The heart's action is slow, 30 to 36, rhythmic, and powerful. The area of cardiac dulness is slightly increased to the left.

On auscultation, a very soft, blowing murmur is heard at the apex; it is systolic in time, of brief duration, and transmitted for a short distance toward the axilla. At the same place where the light impulses above mentioned can be felt, faint, muffled sounds of a very low pitch can sometimes be heard. They are the acoustic equivalents of the light impulses felt during the diastolic period of the heart. They are best heard with the patient placed in the left lateral position. Occasionally the first sound is abnormally loud and harsh, and this coincides with the forcible apex beat mentioned above. There is reduplication of the second sound. The pulmonic second sound is moderately accentuated. The tricuspid sound is apparently normal.

One radial pulse follows each ventricular beat. The radial arteries are soft and compressible. There is no arteriosclerosis of the peripheral arteries. The pulse is infrequent and rhythmic; is rather small, rises quickly under the finger, and falls gradually. The jugular veins pulsate visibly, but only when the patient is in a recumbent posture. Their pulsations extend the whole length of the neck, and are most noticeable on the right side; the veins, however, do not seem unusually distended. The pulsations occur in quick, undulatory rises and falls, which are quite regular and are about three times as frequent as those of the carotid pulse; they bear a definite relation to the light impulses which can be felt over the heart. A better understanding of these pulsations, which were undoubtedly due to auricular contractions, will be obtained through the description of the tracings which accompany this paper.

The systolic pressure is 125 mm. Hg., and the diastolic pressure 80 mm. Hg. (Stanton's instrument).

The pupils react to light and accommodation. The ocular movements are not limited. The conjunctiva and sclera are normal in appearance. There is no strabismus, no ptosis. The media are clear. There is slight œdema of the retina. The arteries are small, the veins not much distended. The field of vision for white and colors shows nothing noteworthy (Dr. Le Fevre).

There are no cutaneous areas of paresthesia, no painful spots; the

corneal sensibility is normal, the pharyngeal sensibility slightly diminished. Babinski's sign and Gordon's paradoxical reflex are absent on both sides. The knee jerks are slightly increased on both sides.

The abdomen shows nothing noteworthy. The uterine displacement mentioned above is a retroflexeion (Dr. Heineberg). There is no œdema of the lower extremities. The urine and blood are normal.

The subsequent history of the patient can be summarized in a few words. She remained in the hospital about nine weeks. She was at first very nervous and cried on the least provocation; the administration of sodium bromide for a few days disposed definitely of this element. Her most constant complaint was that of a "pulling down sensation with each heart beat" and of a lump both in the throat and at the lower part of the sternum. The tugging or bumping sensation about the heart, as she variously described it, distressed her most. She claimed that she suffered a great deal from it, but her appearance certainly did not support her statements. Numerous counts of the radial pulse showed that the prevailing frequency was 32 to 36. The records show that it was once as high as 54 and at another time as low as 26; it was at all times quite regular and was not influenced by posture or emotional disturbances; neither did deep pressure over the vagus have any effect upon it. With the patient in the recumbent posture the jugular veins could always be seen to pulsate 2 to 3 times as frequently as the carotids. The feeble pulsations felt between two systoles and the corresponding faint sounds heard on auscultation varied much in their intensity from day to day, so much so that on certain occasions these phenomena could not be observed. It may be said that they were best marked during the first weeks of the patient's stay in the hospital.

To recapitulate the clinical history of the case, briefly: The patient is an unmarried woman, aged thirty-five years, having, thirteen years ago, given birth to a presumably healthy child. About six months before applying for treatment at the hospital she suffered from intense dyspnœa, which in all probability was of cardiac origin. She presents now symptoms suggestive of neurasthenia. She has a permanently infrequent pulse; there is a systolic murmur at the mitral area, and faint distant sounds are occasionally heard in diastole. On such occasions light impulses may be felt a little above and within the apex.

When the patient first presented herself for examination it was thought that the peculiar action of her heart was produced by extrasystolic irregularity, and that the bradycardia was due to the failure of some of the extrasystoles to give rise to a pulse in the arteries. A simultaneous tracing of the apex beat, carotid and right jugular pulses was therefore taken, in order to ascertain, if possible, the cause of the bradycardia. While the tracing was being taken the patient became very nervous, and her efforts to check an oncoming fit of

crying caused such heavings of her chest as to deform badly the tracing obtained from the apex beat. The carotid and jugular tracings were, however, quite legible, and through these the ventricular systoles could be reconstructed. An analysis of this tracing demonstrates that the ventricular action was infrequent and regular, that there were from two to three auricular contractions to one ventricular, and that auricles and ventricles were beating independently of each other; in other words, the tracing shows complete *a-v* dissociation. The bradycardia was due to the failure on the part of the auricles to excite the ventricles to contraction: there was, therefore, a condition of heart-block. The following table, after the manner of Erlanger, shows the relative frequency of auricles to ventricles at that time.

M. M., JUNE 28, 1908.

No. of Vs.	Duration in $\frac{1}{5}$ sec.[17]	Vs. rate per min.	No. of As.	Duration in $\frac{1}{5}$ sec.	As. rate per min.	As. to Vs.
7	114	33	19	114	90	2.7 to 1

Owing to unavoidable circumstances, I was unable to take any more tracings until August 1, following. In the time which had elapsed since her admission the patient had become a great deal more composed, and under the influence of rest and bromides had become decidedly less nervous. A very satisfactory tracing (Fig. 1) was taken under these circumstances. The ventricular and pulse rate was 33; the auricular (jugular) rate was 100. The tracing records the simultaneous movements of the cardiac apex, the carotid artery, and the right jugular vein. The tracing shows that the ventricular contractions are regular, and that each ventricular systole is followed by an arterial pulse. It will be observed that two small waves are present in each diastolic period. These small waves (*a*) correspond to similar waves in the jugular tracing, and are due to auricular contractions. It will be seen also that the systolic plateau varies with each succeeding systole, becoming gradually more and more deformed as the tracing proceeds. A careful comparison of the jugular and apex tracings shows that the amount of deformity of the systolic plateau depends on the time of occurrence of one of the auricular contractions, as shown in the jugular tracing, viz., the first in each ventricular cycle. The earlier this auricular contraction occurs in the period in which the systolic plateau is produced the more deformed the latter becomes. The abnormally loud and harsh first sound mentioned in the patient's

[17] Some discrepancies having been found between the pulse rate as counted by the finger and as counted by the time markings at the bottom of the tracings, I was led to test the time-marking apparatus, and found that each interruption equalled $\frac{1}{5}$ sec. instead of $\frac{1}{10}$ sec., as indicated on the tracings.

history was possibly due to an auricular contraction occurring soon after the ventricles had begun to contract. An examination of the rest of the tracing, of which Fig. 1 is the part immediately preceding, shows that the following systolic plateau is not quite as deformed as

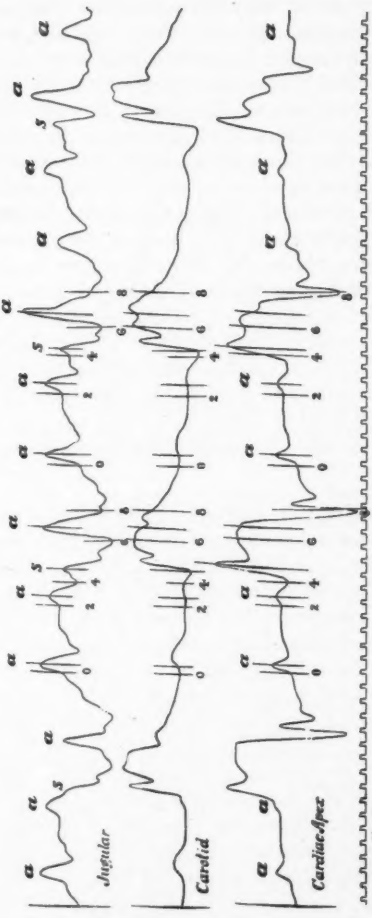

FIG. 1.—Simultaneous tracings of pulsations in the right jugular vein and carotid artery, and of the apex beat. Note that while only two auricular waves are seen in the curve taken from the cardiac apex, there are three auricular waves in the jugular curve.

the last one the tracing here reproduced, and that the succeeding ones gradually assume a normal appearance. This change coincides with the progressive advance of the first auricular systole in each ventricular cycle toward the ventricular diastole. From what has just been said, it is evident that no reliance can be placed in the

cardiogram alone as a means of estimating the number of auricular contractions.

The carotid tracing has on the katacrotic limb a number of abnormal waves. Such waves on the arterial pulse, in cases of heart-block, have been described by Erlanger,[18] Mackenzie,[19] and others, and have been thought by them to be intrinsic in the artery. In the case here presented, however, the waves in question are of extraneous origin and are due to the fact that it was impossible to place the receiver so that the jugular pulsations would be completely cut off. The record of the carotid pulsations was accordingly vitiated. That these adventitious waves occur later than the corresponding true waves on the cardiogram and jugular tracing is attributable to the circumstance that the receiver for the carotid was placed higher on the neck than the one for the jugular vein; the difference in time represents the time lost in the propagation of the venous wave. A tracing obtained from the radial (Fig. 2) shows no evidence of abnormal waves on the katacrotic limb of the pulse.

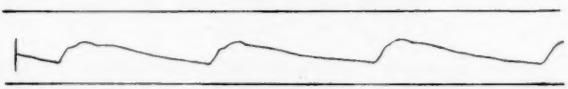

FIG. 2.—Tracing obtained from the right radial artery. There are no abnormal waves on the katacrotic limb of the pulse wave as seen in the other tracings obtained from the carotid artery.

In the jugular tracing the waves marked *a* represent auricular contractions; the wave *s* occurs in the presphygmic period of the ventricular contraction, and is due to the sudden pushing up of the closed tricuspid valve during the rapid rise of intraventricular pressure immediately preceding the opening of the semilunar valves; it is the *c* wave of Mackenzie, and the neighboring carotid artery may contribute in its formation. It will be noted that there are three auricular to one ventricular contraction and that the auricular cycles are quite regular in time, each one occupying about five-tenths of a second. The auricular rhythm, however, bears no relation to the ventricular rhythm. The second auricular contraction on the tracing occurs at a time when the ventricle was just beginning to contract; the distance between each auricular contraction occupying a corresponding place in the ventricular cycle and the following ventricular systole is then seen to increase gradually, and an analysis of the continuation of the same tracing shows that this goes on for one more cycle, when the distance under consideration gradually diminishes until in four ventricular cycles one auricular contraction again falls in the beginning of the ventricular systole. The other auricular contractions shift their position accordingly. In this respect the auricular contraction, which, as mentioned above, caused the systolic

[18] Loc cit.

[19] Brit. Med. Jour., 1906, ii, 1107.

plateau of the ventricular systoles to be deformed, deserves a few words of description. At first glance it might be thought to be the *v* wave found in any negative venous pulse. The mere fact that it changes its position with each succeeding ventricular cycle shows that this cannot be the case; moreover, the wave under discussion bears little or no morphological resemblance to a true *v* wave. Its abrupt anacrotic limb shows that it is due to some suddenly acting force, which I believe is a contraction of the right auricle. This wave also varies in size in the succeeding cycles and in such a manner that it is relatively large when the auricular contraction occurs while the ventricles are contracting, and is relatively small (as at *a'*) when the auricle contracts while the ventricle has just entered in diastole and the auriculoventricular valves are opening. The factors which ordinarily give rise to the *v* wave are no doubt present, and so may add themselves to the auricular contraction in producing a wave of great amplitude. In those instances in which no auricular contraction interferes with its formation the *v* wave makes its appearance (see Figs, 3, 5, 7, 10). An incomplete blending of the *v* and *a* waves is beautifully illustrated in Fig. 6, which is part of a tracing taken five minutes after tracing Fig. 5.

The following table gives the auricular and ventricular rates obtained from tracings taken at a few days' interval and at the time the patient was receiving sodium bromide:

Date.	No. of Vs.	Duration in 1/5 sec.	Vs. rate per min.	No. of As.	Duration in 1/5 sec.	As. rate per min.	As. to Vs.
8-1-'08 (Fig. 1)	11	179.5	32.8	35	187.5	100.8	3.07 to 1
8-3-'08	13	203.0	34.5	41	233.0	95.0	2.75 to 1
8-7-'08	14	190.0	39.7	48	205.0	126.4	3.1 to 1
Average.	..	...	35.6	..	...	107 1	2.97 to 1

The patient then, as shown above, presents the phenomenon of complete auriculoventricular dissociation. She therefore afforded an excellent opportunity for the study of drugs which are known to act on the heart. Among these, digitalis and strophanthus are probably the most important. Digitalis has, however, been thoroughly investigated, and almost, if not all, therapeutists are agreed as to the essential manner of action of the drug. The same cannot be said of strophanthus, some therapeutists contending that this drug acts upon the heart in a manner identical to that of digitalis, while others believe that its inhibiting action is not due to a vagus effect, but to a direct influence on the cardiac muscle. So far as I am aware, the effects which follow the administration of strophanthus in heart-block have never been recorded. The only work of a similar nature is that of von Tabora.[20] This investigator

[20] Ztschr. f. exper. Path. u. Ther., 1906, iii, 549.

experimented on dogs, and after producing complete and lasting dissociation by crushing the *a-v* bundle, injected digitalin intra-

FIG. 3.—Effect of strophanthus. The auricular frequency is diminished in that two and three auricular contractions occur alternately in succeeding ventricular cycles instead of three in each such cycle, as seen in Fig. 1.

venously. Under these circumstances the frequency of the automatically beating ventricles is doubled, while the auricular frequency,

which at first is unaffected, decreases gradually until finally the auricles stop beating; the ventricles go on beating at their high rate.

The patient was, therefore, given 5 minims of the tincture of strophanthus three times a day, and a few days later tracings were taken

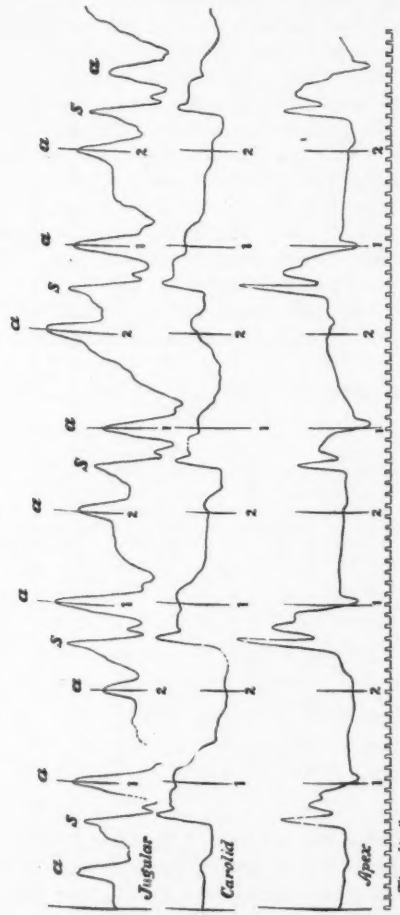

FIG. 4.—Further effect of strophanthus: An apparent 2 to 1 rhythm with, however, greatly prolonged intersystolic period.

to determine the reaction of the auricles and ventricles to the drug.[21] The first noticeable effect was obtained after nine days of the admin-

[21] As a matter of caution, it was deemed safer to give small doses by mouth at regular intervals than to administer a single relatively large dose hypodermically, although the latter might possibly have been more interesting in its results.

istration of strophanthus in the dose mentioned above. From a 3 to 1 ratio (with complete dissociation) the heart's action had changed

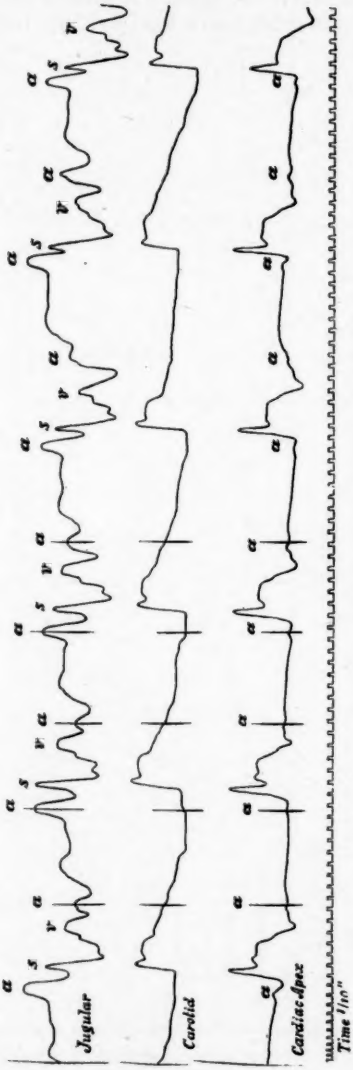

FIG. 5.—Same as Fig. 4. Here, however, the resemblance to a 2 to 1 rhythm of incomplete heart-block is still more striking.

to an alternate 2 to 1 and 3 to 1 ratio, complete dissociation still persisting (Fig. 3). Four days later the *a-v* ratio was 2 to 1 (Fig. 4).

Dissociation of auriculoventricular rhythm was still present, but it was apparently of a lower grade, and every other auricular contraction was followed by a ventricular contraction, although, if any impulse was transmitted from auricles to ventricles, the time occupied in its transmission was abnormally great (about four-tenths second). Another tracing taken on the same day shows in the last three ventricular cycles, at least, a typical 2 to 1 rhythm (Fig. 5). The features of an incomplete *a-v* dissociation with a 2 to 1 rhythm, as shown in Figs. 4 and 5, are, however, only apparent and are the consequence of a fortuitous adaptation of the auricular to the ventricular rhythm under the slowing action of strophanthus on the auricles. In support of this view, Erlanger's[22] experiments may be cited. This observer found that when the block between auricles and ventricles is not complete, but owing to the relatively high auricular rate the *a-v* dissociation is complete, a slowing of the auricular rate by any appropriate means will be followed by 3 to 1, 2 to 1, or even normal rhythms; but under these circumstances the rate of the ventricles increases suddenly with each variation in the rhythm. The table which follows shows that the ventricular rate was not materially affected by the change in the rate of the auricular contractions.

AURICULAR AND VENTRICULAR RHYTHMS UNDER THE INFLUENCE OF STROPHANTHUS.

Date.	No. of Vs.	Duration in 1/5 sec.	Vs. rate per min.	No. of As.	Duration in 1/5 sec.	As. rate per min.	As. : Vs.
8-24-'08 (Fig. 4)	11	186.0	32.0	27	191.5	76.0	2.3 to 1
8-28-'08 11 A.M.	8	124.0	34.8	18	136.0	71.0	2.0 to 1
8-28-'08 11.10	6	102.0	31.76	14	116.0	65.1	2.0 to 1
8-28-'08 11.20	8	132.0	32.72	18	148.0	65.94	2.0 to 1
8-28-'08 11.30	8	132.0	32.72	20	152.0	71.05	2.17 to 1
8-28-'08 12 M.	8	130.0	33.23	16	132.0	65.44	2.0 to 1
8-28-'08 (Fig. 5) 12.05 P.M.	5	77.5	34.8	10	78.0	69.2	2.0 to 1
8-28-'08 (Fig. 6) 12.10 P.M.	6	96.0	33.7	12	95.0	68.2	2.0 to 1
Average.	..	...	33.2	..	...	68.9	2.07 to 1

From the facts adduced above, we might feel justified to infer that the block between auricles and ventricles is, in this case, complete. I will later bring additional evidence to prove that this inference is in all probability correct. The same facts, namely, a slowing of the auricular rate, the ventricular rate remaining practically constant, offer an explanation regarding the mode of action of strophanthus on the heart. It has been shown by Erlanger

[22] Brit. Med Jour., 1906, ii, 1111.

and others that stimulation of the vagus in complete heart-block, while inhibiting the auricles in the usual way, has little or no effect on the ventricles. Conversely, removing vagus influence, as by cutting both vagi, will result in an increase in the auricular rate, the block being, of course, complete. It is, therefore, believed that the vagus acts directly on the auricles only, and that the inhibition of the ventricles, which in the normal heart follows stimulation of the vagus, is secondary to the inhibition of the auricles. The explanation of the action of strophanthus is therefore obvious, at least in so far as this instance is concerned; it slows the heart by stimulating the vagus nerve. If strophanthus slowed the heart's action by a direct effect on the muscle cell, both auricles and ventricles would have been proportionately slowed. Such, however, was not the case. It is, indeed, difficult to conceive that a drug

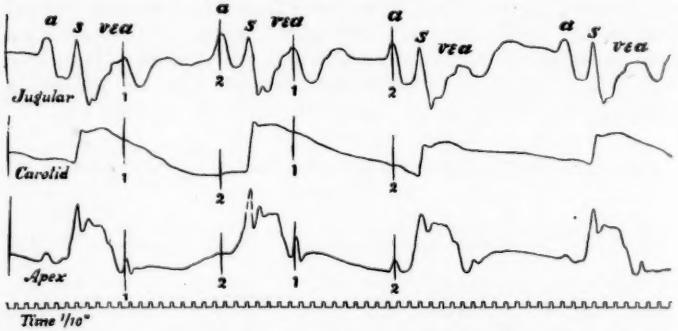

FIG. 6.—To illustrate the bending of the *v* wave with an auricular wave as the latter gradually falls into the protodiastolic period of the ventricular cycle.

could so depress the cardiac muscle as to lower the frequency of its contractions and at the same time increase the force of these contractions (which latter is generally conceded to be an effect of strophanthus). The administration of the drug was then discontinued, and an analysis of several tracings taken two days afterward showed the ventricular rate to be 31.9, the auricular rate 84.1, and the *As.* to *Vs.* ratio of 2.6 to 1. The tracing shows again complete *a-v* dissociation (Fig. 7).

From what has been said above, any agent which is known to slow the entire normal heart through vagus stimulation may be used as a means of testing the degree of heart block.

Another method of testing the extent of the block between auricles and ventricles consists in the hypodermic use of atropine. The employment of this drug was first recommended by Dehio[23] as a

[23] St. Petersb. med. Woch., 1892, xvii, 1; Deut. Arch. f. klin. med., 1893, lii, 97.

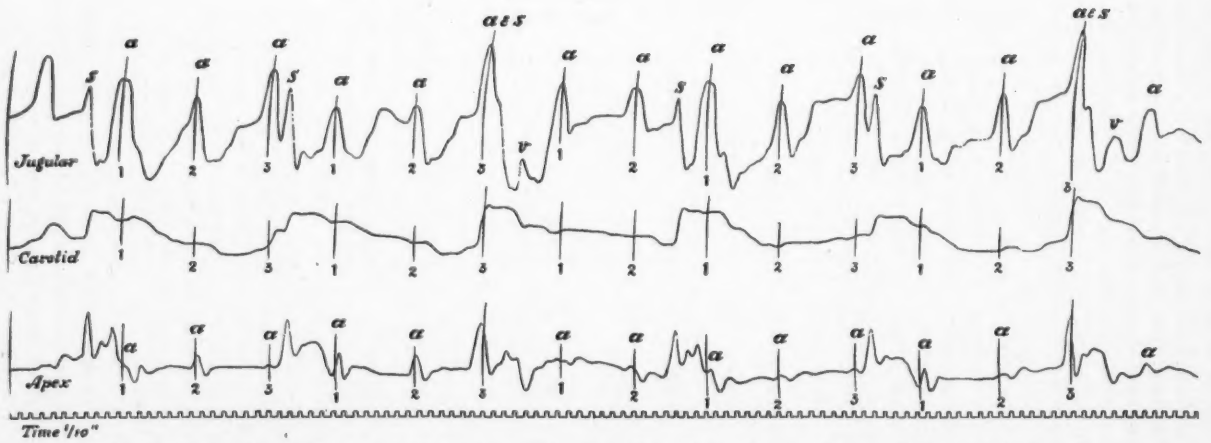

FIG. 7.—Tracing showing the effect of withdrawal of strophanthus. The auricular frequency is increased; the ventricular frequency is unaffected; the dissociation is complete.

diagnostic measure, in cases of slow or irregular hearts, in order to ascertain what part the inhibitory apparatus plays in bringing about the abnormal function. He employed it in a case of the Adams-Stokes syndrome, and observed that the pulse frequency was not

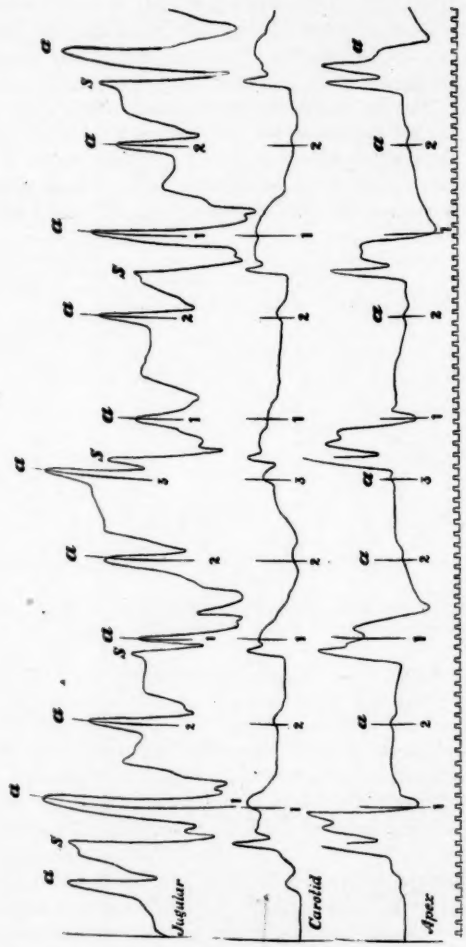

FIG. 8.—Tracing showing the relative rhythms of auricles and ventricles previous to the hypodermic injection of atropine, $\frac{1}{50}$ grain. Note the amplitude of the auricular waves.

notably affected. Other similar observations upon cases of heart block have been made since by different authors. The study of the effect of atropine on the auricular rate of contraction in heart-block is comparatively recent, and only a few observations are at

hand (Erlanger,[24] Ritchie,[25] Gibson,[26] Leuchtweis,[27] Schmoll[28]). Under the influence of atropine the auricular rate is more or less accelerated, while the ventricular rate is practically uninfluenced if the block is complete. If, however, the block is incomplete, some of the auricular impulses passing over to the ventricles, the latter's rate increases with the increase in the frequency of the auricular contractions. This, of course, has its explanation in what has been said previously concerning the mode of action of the vagus nerve.

The dose of atropine necessary to produce such effects must be relatively large. I tried successively and on different days doses of $\frac{1}{200}$, $\frac{1}{150}$, and $\frac{1}{100}$ grain hypodermically without appreciable results, in spite of the fact that mydriasis, flushing of the cheeks, and dryness of the throat were present in every instance. Finally $\frac{1}{50}$ grain was injected hypodermically, with the result seen in the table below:

EFFECT OF ATROPINE, $\frac{1}{50}$ GRAIN HYPODERMICALLY.

No. of min. after injection of atropine.	No. of Vs.	Duration in $\frac{1}{5}$ sec.	Vs. rate per min.	No. of As.	Duration in $\frac{1}{5}$ sec.	As. rate per min.	As. to Vs.
Before (Fig. 8)	12	205.5	31.53	30	225	72.0	2.28 to 1
10	6	96.0	33.75	18	101	96.23	2.85 to 1
20	6	92.0	35.32	20	100	108.0	3.05 to 1
25	10	160.0	33.75	36	168	115.7	3.42 to 1
35	6	89.0	36.4	22	96	123.7	3.39 to 1
45 (Fig. 9)	6	95.0	34.1	23	102	122.9	3.60 to 1
55 (Fig. 10)	6	100.0	32.4	22	106	112.0	3.36 to 1

This table shows conclusively that under the influence of atropine the auricular rate is noticeably accelerated. There is also, in this instance, a slight increase in the rate of ventricular contraction, but that this bears no direct relation to the increase in the auricular rate is shown by two facts: the gradual increase in the *As.* to *Vs.* ratio, and the return, at the close of the test, of the ventricular rate to a frequency closely approximating that obtaining at the beginning of the test, although the auricular rate is still relatively high. So far as the tracings are concerned, they all show complete dissociation; another point which is observed is the gradual diminution in the amplitude of the auricular waves as the auricular contractions increase in frequency. It will be noted that the greatest auricular acceleration occurred in thirty-five to forty-five minutes following the atropine injection. This tallies essentially with the findings of Erlanger.[29] Owing to the fact that the tracings were not

[24] Jour. Exper. Med., 1905, vii, 676.
[25] Brit. Med. Jour., 1906, ii, 1113.
[26] Ibid., lxxxvii, 554.
[27] Proc. Roy. Soc. Edinb., 1905, xxv, 1085.
[28] Deut. Arch. f. klin. med., 1906, lxxxvi, 456.
[29] Loc cit.

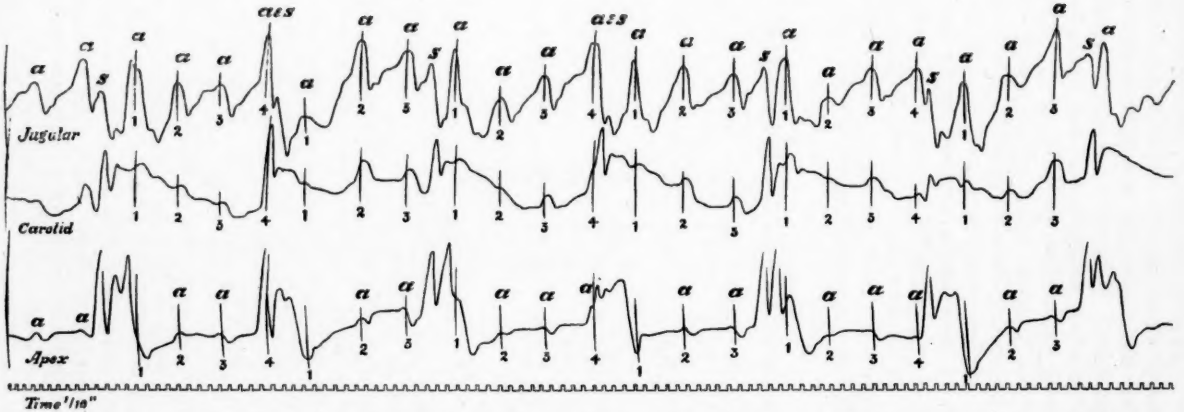

FIG. 9.—Tracing showing the effect of atropine forty-five minutes after injection. The auricular wave is distinctly accelerated; the ventricular rate practically uninfluenced. The auricular waves are of less amplitude than in Fig. 8.

taken at closer intervals, the preliminary slowing in the auricular contractions mentioned by the last-named investigator escaped notice.

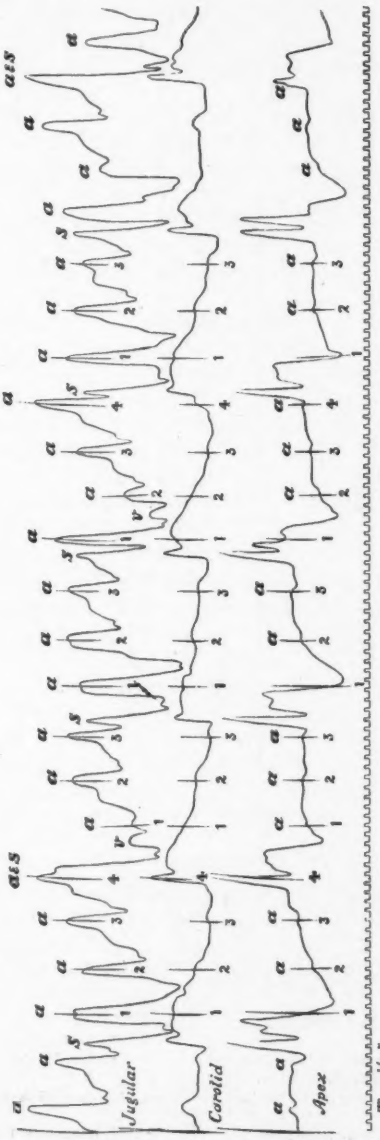

FIG. 10.—Tracing taken ten minutes later. The auricular frequency is beginning to decrease. The amplitude of the auricular waves is slightly greater than in Fig. 9.

Apart from intense dryness of the mouth and throat, the patient did not suffer any inconvenience from the test. Besides this subjective symptom, the patient had flushed cheeks and dilated pupils. It would have been interesting to observe the return of the heart's action to its former condition, but the patient, complaining of being tired, refused to submit any longer to the taking of tracings, and the test had to be discontinued.

The behavior of the heart under the influence of atropine strengthens us in the belief that the block between the auricles and the ventricles from which the patient is suffering is organic. Furthermore, the block is, in all probability, complete. If we may use the relatively few cases which, having been studied clinically, have been followed by a careful postmortem examination of the heart, and draw inferences from these, then the mere presence of complete auriculoventricular dissociation would be sufficient in itself to justify a diagnosis of profound organic change in the *a-v* bundle. (See Luce[30] (heart studied by Fahr[31]), Schmoll[32] (Case II), Jellinek and Cooper[33] (Case I), Ashton, Norris, and Lavenson,[34] Karcher and Schaffner,[35] Stengel,[36] James.[37]) There are two cases, however, which contradict this statement. One of these cases is that of Deneke,[38] in which there was complete dissociation and the *a-v* bundle was found to be normal, but there was dilatation of the heart and fibrous myocarditis, so that it is possible that the ultimate ramifications of the bundle into the Purkinje fibers, as described by Tawara, may have become implicated in the pathological process. The other case is one reported by Heineke, Müller and v. Hösslin;[39] in this instance the dissociation was partial, although later it became complete. An examination of the heart showed that there was not a vestige left of the *a-v* bundle. The patient who was the object of this investigation had suffered from this condition probably for many years (the syncopal attacks had begun thirty-five years before death). The last-named authors, therefore, think that other pathways exist and may be called into action when the main conducting system has been destroyed, or that under such a circumstance new pathways may form and transmit the excitation wave from auricles to ventricles.

The phenomenon of auriculoventricular dissociation is seldom found alone; it is generally seen in association with certain nervous disturbances, which are of varying intensity, occur in definite attacks, and are part of the symptom-complex with which the names of Adams and Stokes are connected. The number of cases of Adams-

[30] Deut. Arch. f. klin. Med., 1902, lxxiv.
[31] Loc cit.
[32] Loc. cit.
[33] Brit. Med. Jour., 1908, i, 796.
[34] Amer. Jour. Med. Sci., 1907, cxxxiii, 28.
[35] Berl. klin. Woch., 1908, xxvii, 1266.
[36] Amer. Jour. Med. Sci., 1905, cxxx, 1083.
[37] Ibid., 1908, cxxxvi, 469. (In the last two cases no histological study of the *a-v* bundle has as yet been reported.)
[38] Arch. f. klin. Med., 1906, lxxxix, 39.
[39] Ibid, 1908, xciii, 459.

Stokes syndrome is greater than one would suppose. Beginning with Morgagni, I have been able to collect 177 cases of this symptom-complex. If we begin with Mayo, then of these 177 cases, 87 presented the evidences of auriculoventricular dissociation. The reports of these cases are, of course, of widely unequal merits, so that conclusions from these numbers should be made with caution. It is noteworthy, however, that within recent years very few cases of Adams-Stokes syndrome without heart-block have been reported. The number of cases of heart-block without attacks of vertigo, syncope, and epileptiform seizures, etc., is equally very small. In most of them the dissociation has been transient in character. It may occur in the course of an acute infection, as in influenza (Mackenzie[40]), acute rheumatic fever (Joachim,[41] Gerhardt[42]), and in malignant endocarditis (James [43]). It has been observed in failing compensation (Chauffard,[44] Gibson[45]), and without evident cause (Jellinek and Cooper,[46] Case II). All of these cases recovered except Gibson's and James'. In Jellinek and Cooper's case the recovery followed the administration of potassium iodide. Both Gibson's and James' cases came to autopsy, and the findings are corroborative of the now well-established facts concerning the physiology of the *a-v* bundle. In Gibson's case, which had exhibited partial dissociation, the pericardial sac was completely obliterated, the pericardium being greatly thickened especially over the ventricles. The heart muscle was healthy, even close to the auriculoventricular bundle, but the latter was of a paler color than normal and showed cellular infiltration and a notable increase in fibrous tissue; the muscle fibers of the bundle were thereby widely separated from each other. In James' case the *a-v* dissociation was complete, and at autopsy an extensive ulcer was found in the interventricular septum, which, from its position, is thought to have destroyed the bundle; so far there has been no histological examination made.

These cases, together with the one here reported, show indubitably that heart-block with its usual bradycardia can occur independently of any nervous disturbance, which latter, as before stated, is part of the Adams-Stokes syndrome. I call attention to this fact because there has been a tendency of late to confuse and assimilate the two terms, Adams-Stokes syndrome and heart-block, as synonyms. Why attacks of vertigo, syncope, etc., should occur with certain cases of heart-block and not with others cannot as yet be satisfactorily answered. In nearly all cases of heart-block, with the Adams-Stokes syndrome, it has been observed that the attacks were immediately preceded by stoppage of the ventricles, the auricles continuing to beat regularly. The vertigo, loss of consciousness,

[40] Brit. Med. Jour., 1902, ii, 1411.
[41] Zeitschr. f. klin. Med., 1907, lxiv, 95.
[42] Arch. f. exper. Path. u. Pharm., 1904, li, 11.
[43] Loc. cit.
[44] Rev. gén de clin. et de thérap., 1907, xxi, 437.
[45] Loc cit.
[46] Loc cit.

and epileptiform convulsions are therefore thought to be secondary to the arrest of the ventricles and due to anemia of the nerve centres. What the cause of ventricular stoppage is we do not know.

It may be added that the patient who is the object of this report has been receiving potassium iodide for a number of weeks, and that so far it has had no effect on the heart's action. Having had the opportunity of seeing the patient recently, I took a tracing, which on analysis showed a ventricular frequency of 36, auricular frequency of 87, and an *As.* to *Vs.* ratio of 2.4 to 1, with complete dissociation. The thought comes naturally to one's mind that this patient may sooner or later develop the full Adams-Stokes syndrome; she may also recover. Whatever will be the outcome of this disorder, there is at the present time no indication pointing one way or another. There is nothing in the patient's symptoms which would even suggest those ill-defined attacks classified by Huchard under the term *formes frustes.*

THE ORIGIN OF THE "NEW-LEATHER" AND "DRY FRICTION" SOUNDS HEARD ON AUSCULTATION.

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The diagnostician is wont to consider the signs elicited by physical examination to be objective, mechanical, and certain in their significance; but he loses nothing in accuracy if he realizes that, after all, the interpretation of these signs is largely a work of the imagination. Listening at the telephone, we may feel positive that we identify the person whose voice we hear, and later find that another has spoken. The very terminology of auscultatory signs is a more or less unhappy train of metaphor. "Moist" and "dry" are useful, but hardly defensible adjectives. The "gallop rhythm" approaches ideal descriptiveness, and the "bruit de cuir neuf," the creaking sound made by new leather, is recognized by its quality at the first hearing. Any number of competent examiners perceiving these sounds in listening to a chest would probably agree in designating them as the "new-leather sounds." But if conclusions were ventured as to the source and significance of the signs, it is probable that the diagnostic deductions would vary widely one from the other. In my experience the new-leather sound has usually seemed to characterize certain chronic pathological pulmonary states in which extensive fibroid changes in the lungs and pleuræ were to be predicated. In certain cases the sounds appear to have their origin in the bronchial tubes and to be due to the vibrations of tenacious mucus. Sahli[1] ascribes

[1] Diagnostic Methods, Trans., p. 239.

the sounds to a pleural friction. Rosenbach[2] points out that the presence of tubercles, tumors, etc., in the pleura may give rise to the creaking sounds, as well as may inflammatory changes in the membrane; but he describes, also, a "pseudopleural friction rub," which has the typical creaking characters, and which, moreover, conveys to the touch a vibratile fremitus often of great intensity. This sign is, according to Rosenbach, muscular in origin, being due to contraction of the intercostal, thoracic, and dorsal muscles; it is usually symmetrical on both sides of the chest in individuals having wide intercostal spaces, and preferably affects the lower, more movable parts of the parietes and the interscapular spaces.

In a study of the inflammatory changes of the intercostal muscles accompanying infective processes in the lung and pleura, Coplin[3] points out that intermuscular friction of the altered fibers could very well give rise to a wide range of pseudopleural sounds, including, especially, the *bruit de cuir neuf*. Indeed, the frequency with which the thoracic muscles show microscopic alterations as a result of pulmonary infection suggests that the auscultatory signs intrinsic in its muscular parietes may have a much more general significance in diseases of the chest than is generally attributed to them.

The excuse for the present note is a recent clinical experience in which positive proof was afforded that "new-leather sounds" as well as the "dry friction rub" may be perceived in the chest wall when there can be no suspicion of pleural friction.

Mr. M., aged twenty-seven years, a clerk, was well until about April, 1907, when he developed what was supposed to be typhoid fever. The disease failing to yield, critical examination later revealed active pulmonary tuberculosis. The patient came to Denver early in September, 1907. He was much emaciated, had diarrhœa, and manifested signs of active tuberculosis in the upper two-thirds of both lungs, with a cavity at the right apex. The heart was in the normal position, and there were no thoracic signs unusual to the condition. The patient's condition improved considerably, and he enjoyed, for the most part, freedom from all distress, except for the repeated occurrence of attacks of profuse epistaxis, until the night of November 19, when he was suddenly seized with intense pain in the left side of the chest, together with urgent air-hunger. The distress yielded to a hypodermic injection of morphine, and when I saw the patient the next morning he was comfortable.

The physical signs at this time pointed unmistakably to the development of pneumothorax of the left side. The heart appeared to be wholly to the right of the sternum. The left wall of the chest was much more prominent than the right, it was nearly immobile, the rib spaces were very wide, and there was tympany to percussion throughout the left front and side. The breath sounds were feeble

[2] Nothnagel's System, Diseases of Bronchi, Pleuræ, and Lungs, p. 864.
[3] Amer. Jour. Med. Sci., 1904, cxxvii, 754.

and metallic in character, but there were no signs which could have arisen from the chest wall or the pleura. The patient while completely at rest continued to enjoy extraordinary comfort until December 13, when he was again seized suddenly with a very disagreeable sensation, described as a "tightness" in the left upper part of the chest and accompanied by considerable dypsnœa. The acute distress disappeared after a few hours, when physical examination showed, as before, tympany and distention of the left side of the chest, with the addition, however, of very strong "new-leather" sounds over the whole area to the left of the sternum, extending from the first intercostal space to the sixth space and as far outward as the anterior axillary line. With respiratory motion, there was over this area, at least, close to the sternal border, marked tactile fremitus, which seemed very superficial, as if from crepitation in the chest wall itself. Subsequent examination of the patient day by day showed the gradual disappearance of the tactile fremitus except along the lower left edge of the sternum. The new-leather sounds changed their character little by little to a quality I have commonly noted as a "dry pleural friction rub." The breath sounds were faintly audible, and had lost their metallic nature. The patient continued untroubled until December 29, when, after a comfortable night, he was again suddenly attacked with air hunger, and died within an hour or two.

The autopsy revealed the following conditions: The heart was wholly to the right of the middle line, the long axis of the organ was somewhat more nearly parallel than usual to the long axis of the body. The right lung contained a considerable cavity in the apex, was nearly solid with tubercles, and was closely adherent to the chest wall. The left lung was completely collapsed and reduced to the size of one's fist. An air space three inches broad separated its surface from the thoracic wall in all directions except posteriorly. The posterior superior margin of the lung was prevented from complete collapse by long adhesions to the pleural apex. Only that part of the organ could be made to crepitate. The two lobes of the lung were tightly sealed together. Tubercles were found scattered throughout the lung, which had evidently been long in a state of collapse. The pleural surfaces did not glisten, and the *cavity contained no fluid.*

Unfortunately no microscopic examination was made to determine the tissue changes which might have given rise to the physical signs observed, but no reasonable doubt can exist that these signs, the tactile fremitus, the "new-leather" and "dry friction" sounds, had their origin in the chest wall itself, and must have been due to the rubbing together of tissue elements during respiratory movement. The clinical history of the case makes it evident that the morbid signs attributed to changes in the chest wall appeared suddenly, accompanied by subjective distress, nearly four weeks after the advent of the pneumothorax.

HABITUAL OR RECURRENT ANTERIOR DISLOCATION OF THE SHOULDER.

II. TREATMENT.

By T. Turner Thomas, M.D.,

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Beyond the wearing of an apparatus, usually made of leather, I know of nothing, except operation, which may be expected to prevent recurrences of the dislocation. My patient wore an apparatus of this kind, and, while it seemed to aid in reducing the number of recurrences, the luxation did occur while he was wearing it. It did not permit him to abduct the arm to the horizontal position, and became burdensome. Schüller's patient experienced innumerable recurrences in spite of such a leather brace. Massage, electricity, and active and passive movements have been advised, but in view of the pathology of this condition, I cannot see how they could be expected to produce a cure.

Operations. Albert[1] prevented the recurrences in his case by an operation, which produced a bony ankylosis of the shoulder-joint (arthrodesis). It is hardly conceivable that any surgeon today would perform this operation. Cramer, Küster, Kraske, Popke, Volkmann (quoted by Popke, three cases), Schüller, Staffell[2] (two cases), W. Müller,[3] and Francke have resected the head to prevent the recurrences. Perthes said that the operation of resection has been abandoned. Picque,[4] however, in 1905, did this operation on one of his cases.

Capsulorrhaphy. Although the credit for the first capsulorrhaphy is generally given to Ricard, of France, who did the first of his two operations in 1892, Gerster,[5] of New York, accomplished the same purpose by excising a piece of the capsule and suturing the edges of the opening together, in 1883, and Bardenheuer, in 1886, excised two pieces of the capsule. Good results were obtained in both cases. The two essential features of the operation are, the method of approaching the capsule and the method of shortening the relaxed portion, that is, removing the hernial pouch.

The shoulder is covered completely by the deltoid on the outer and posterior sides, and by the deltoid and pectoralis major on the anterior side. In most of the recorded cases the usual incision for a resection of the shoulder was employed. This passed from about

[1] Internat. klin. Rundschau, February 26, 1889, No. 9.
[2] Verhandl. d. Deut. Gesellsch. f. Chir., 1895, xxiv, 651.
[3] Ibid., xxvii, 154.
[4] Bull. et. mém. d. l. soc. d. chir. d. Par., N. S., xxxi.
[5] Med. News, Phila., 1884, xliv, 423.

the coracoid process downward a variable distance toward the insertion of the deltoid, and either divided the anterior fibers of the deltoid or separated it from the pectoralis major. Burrell[6] and Warren,[7] in addition, divided the greater part of the insertion of the pectoralis major to allow its retraction inward. Ricard and Samter[8] added to the vertical a horizontal incision extending outward from the upper end of the vertical incision along the origin of the deltoid muscle below the acromion and clavicle. Stimson made a similar horizontal incision outward from the middle of the vertical incision. Krumm, after making a vertical incision, turned the long head of the biceps out of its groove, replacing it later. Perthes varied the incision in each of his four cases. In the first he carried it from the coracoid process along the anterior margin of the deltoid nearly to its insertion, and then turned it upward along the posterior border of this muscle about half way. The skin and muscle flap was reflected upward without injury to the circumflex nerve. In his second case, he employed the posterior resection incision at the posterior border of the deltoid. An incision was then made along the spine of the scapula and acromion, and a 0.5. to 0.75 cm. strip of these bones chiselled off through a corresponding series of holes, which were made first. The flap was turned downward and forward. In his third case, he made an incision along the anterior margin of the deltoid, and then separated this muscle from the pectoralis major. Above the coracoid process the fibers of the deltoid were divided up to the clavicle. One centimeter from its end the coracoid process was first bored through for the later introduction of a wire suture. The coracoid was then sawed through and turned downward with the attached corabrachialis and short head of the biceps muscles. The pectoralis major was later divided for retraction inward. The object of this extensive incision was to expose the anterior margin of the glenoid cavity. In the fourth case, he employed the usual anterior resection incision, and in addition partially divided the deltoid at its origin from the clavicle. There is evidently a need of more uniformity in the method of approaching the capsule. While the anterior resection incision was generally used, as already stated, it was frequently found to give an insufficient exposure of the field of operation. Under any circumstances, such an incision is an extensive one. More attention should be paid to the underlying rotator muscles. Only one surgeon, Samter, it appears, divided the subscapularis muscle to obtain a freer exposure of the anterior dilated portion of the capsule. In my opinion, this is very desirable, and proved very serviceable in my own case. This muscle covers the whole anterior part of the capsule, with which it is intimately adherent, and can be drawn aside only with difficulty.

[6] Trans. Amer. Surg. Assoc., 1897, 293.
[7] Bost. Med. and Surg. Jour., March 12, 1903.
[8] Verhandl. d. Deut. Gesellsch. f. Chir., 1900, xxix, 641.

I believe that the simplest, safest, and most effective operation can be done through an axillary incision. This conclusion was reached after a careful study of the dissected specimen, and seemed to be justified later by the operation. Kraske and Küster employed the axillary incision in resecting the head of the humerus for this condition. Burrell said that the operation was distinctly an anatomical one. This is true whatever method of approaching the joint is employed. A point which should be borne in mind is that the coracobrachialis and biceps pass downward over the subscapularis and front of the capsule close to the humeral attachment of the latter, so that a better exposure of the subscapu-

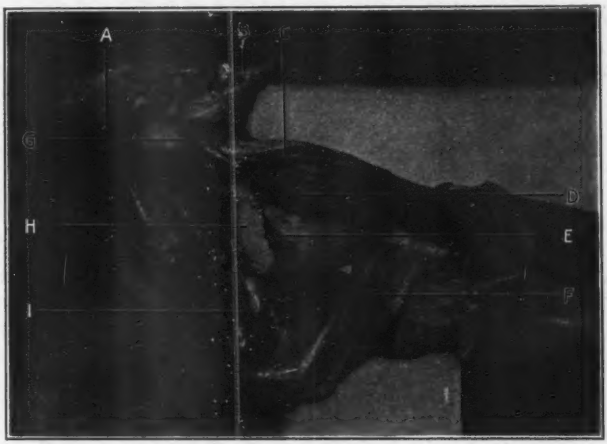

FIG. 1.—Experimental anterior dislocation of left shoulder, with the arm at right angles to the body. Anterior view. Deltoid and pectoralis major removed. *A*, clavicle; *B*, acromion process; *C*, coracobrachialis and biceps muscles; *D*, external portion of divided subscapularis muscle; *E*, edge of capsule torn from anterior and lower glenoid margin; *F*, latissimus dorsi muscle; *I*, inner portion of divided subscapularis; *H*, head of humerus; *G*, coracoid process.

laris, the underlying capsule, and the anterior glenoid margin can be obtained to the inner side of these muscles than to their outer side (Fig. 1). The usual resection incision through the anterior fibers of the deltoid will lie to their outer side, an axillary incision to their inner side. The head of the humerus is more superficial in the axilla than on any other side, and with abduction of the arm it is brought still nearer to the surface. The only muscle divided in my case was the subscapularis, and even this could be avoided by attacking the capsule below its lower border, as did Warren, although division of the muscle gives a much freer exposure and permits a more effective operation upon the capsule. It will be recalled that Perthes, in order to expose the anterior glenoid margin,

found it necessary to make an extensive and mutilating incision. The coracobrachialis forms an excellent guide for the axillary incision, so that the surgeon can easily pass inward between it and the axillary vessels and nerves without danger. There will be less danger to them than in the operation for ligating the axillary artery, since in the operation for the luxation we are not working on the vessels, but merely keeping them out of danger by a retractor. The musculocutaneous nerve which enters the coracobrachialis muscle at the lower part of the wound crosses the field of operation, and should be sought and retracted inward with the other nerves and the vessels. This exposes the subscapularis muscle, at the lower edge of which, between it and the upper border of the latissimus dorsi, the circumflex nerve and posterior circumflex vessels are easily located. The small anterior circumflex vessels must be divided between ligatures to permit retraction inward of the large vessels. A grooved director is then passed from below upward between the subscapularis and the capsule, and the muscle is divided. The cut ends of the subscapularis are then separated from the capsule and turned to their respective sides. In my case this gave a sufficient exposure of exactly the part of the capsule torn, now presenting a protrusion.

While excellent results have been obtained by reefing the capsule without opening it, exploration of the interior of the joint will be advisable, through an opening, to detect and remove any movable joint body and to repair any other lesion that may be present. This may be a tearing off of the long head of the biceps from its origin, which has been shown to have occurred, or a torn external rotator, which has been reported, but which I regard as not demonstrated. If necessary, an additional incision could easily be made over these structures through the deltoid under the guidance of the finger in the joint. This will rarely, if ever, be necessary. If one found, as I did, the margins of the original tear, they could be brought together by sutures (Figs. 2 and 3). If the relaxed capsule were thick and strong, with no recognizable signs of a tear, then it could be contracted by sutures and the opening in the capsule closed, or the same purpose could be accomplished by overlapping the edges of the opening in the capsule, as was done effectively by Mikulicz, or by excising a piece of the capsule. The exact method of shortening and strengthening the capsule does not seem to be a very important matter, judging from the good results obtained from the numerous methods employed by the various operators. According to Hildebrand, Genzmer injected iodoform into the affected joint, with a cure in two cases. Operation for the radical cure of inguinal hernia has, at least, not a better record. No deaths or ankyloses of the shoulder have been reported, so far as I could find, and only two recurrences. In one of these (Legueu[9]) the patient was an epileptic and had convulsions soon after the operation,

while the arm was still in the dressing. Eighty-five days, or twelve weeks, after the operation, in an epileptic attack he fell on the affected shoulder and thus experienced a new dislocation. Such a fall might readily produce a dislocation in a normal shoulder, and the case should not be considered one in which the operation failed

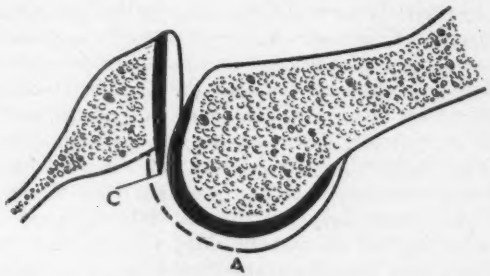

FIG. 2.—Tear in the capsule about one-half inch from the glenoid margin, found at operation in the case herewith reported. *A*, torn margin of the axillary portion of the capsule, still attached to the humerus; *C*, torn margin of the portion attached to the glenoid cavity.

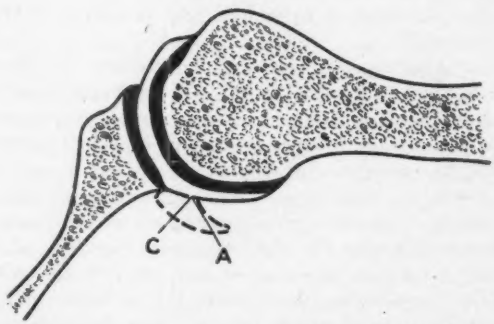

FIG. 3.—Repair of a rent found in the case herewith reported. The two torn margins of the capsule, *A* and *C*, were brought together by sutures. The new or cicatricial portion of the capsule was not removed, but was widely opened by the operative incision.

to cure. The other case, in which a recurrence followed the operation, was merely referred to by Hildebrand as having occurred in the practice of Haegler. I could not find a report of the case in the literature. Whenever the function of the shoulder, after the operation, was referred to it was always good, although it may not always have been perfect. Many of the cases were only briefly reported before societies, sometimes merely in the discussion of some paper, so that the detail necessary for a satisfactory study is lacking.

[9] Bull. et. mém. d. l. soc. d. chir. d. Par., N. S., xxxi, 573.

It is very probable that this operation has been unsuccessful in some cases that have not been published. We can determine its standing, however, only from the recorded cases, and upon that basis it has been eminently successful. The following is a brief summary of the functional results in the 34 capsulorrhaphy cases: In 27 the movements of the shoulder after operation were variously reported as perfectly normal, free, active without hindrance or with slight limitation of motion. In one of Burrel's two cases the operation had been done too recently to permit a report on the results. In Gerster's case the movements promised to become normal. Bardenheuer said of his case that it was successful, and that there had been no recurrence four months after operation. Wiesinger reported that the results were good in his case, and that in spite of severe epileptic attacks since the operation, there had been no recurrence. In Stimson's[10] case there had been no recurrence six months after operation, and of Meyer's[11] case it was merely reported that there had been no recurrence up to the time of the report. As already stated, in Legueu's case there developed a recurrence twelve weeks after operation, from a cause sufficient to produce a luxation in a normal shoulder. Although before operation his patient had had a dislocation with nearly every epileptic attack, since the operation he had had several attacks, but only the one luxation.[12]

PERSONAL CASE. A young man, an athlete, aged twenty-three years, on November 26, 1904, while playing football, fell with both arms in abduction, and immediately experienced a severe pain in his right shoulder. Some companions at once pulled on the arm. A doctor, who was present, examined him soon afterward, and decided that there was no dislocation. Five days later, on Thanksgiving day, he played in another game, and again had a similar accident to the same shoulder, but he did not suffer as severely as in the first. Later, during the same evening, he fainted. During the following June, while wrestling in a gymnasium, he dislocated the same shoulder twice in the same evening, manipulations being necessary for the reduction both times. In September, 1906, he began to wear a leather shoulder brace, the chief object of which was to limit abduction. Previous to this time he had nine dislocations. Soon after beginning the use of the brace, and while it was in position, a dislocation occurred. This occurred on two other occasions, so that he had three dislocations while wearing the brace. He first consulted me soon after the brace was obtained, and again about a year later, or about a week after the last recurrence.

Examination at this time showed slight atrophy of the shoulder

[10] Annals of Surgery, 1898, 364.

[11] Ibid., xlvii, 811.

[12] The following are references to cases not already specifically alluded to: Dehner, Munch. med. Woch., 1899, No. 5, 165; Grothe, Ibid., 1900, No. 19, 650; Wolff, Zentralbl. f. Chir., 1908, xlvii, 811; Albee, Amer. Jour. Surg., 1908, xxii, 210.

muscles. He could not produce firm contraction of the biceps on the affected side, and the arm was ¼ inch less in circumference than the left. Movements of the shoulder were free in all directions except for the limited abduction due to fear of recurrence.

Operation, January 18, 1908, at St. Agnes' Hospital. The affected arm was placed at right angles with the body, and an incision about 6 inches long was made from the highest part of the axilla along the prominent coracobrachialis muscle, and underneath the pectoralis major. The capsule was exposed, as already described. Between the divided ends of the subscapularis muscle the capsule was very thin, and had been opened by the grooved director. The finger, introduced into the joint, detected nothing abnormal, except a considerable pouch under the coracoid process, continuous with the joint, and having a smooth inner surface. After turning aside the two portions of the divided muscle, it was seen that the capsule had been torn parallel with the glenoid margin, anteriorly and below. The outer torn edge was continuous with the thin new portion of capsule (Figs. 2 and 3), both being adherent to the under surface of the subscapularis, so that the line of union between the thin new and the normally thick old portion was located only after some search. The upper torn edge was seen attached to the glenoid margin, dividing the new space to its inner side from the normal joint to its outer side. It was somewhat shrivelled and shortened by angulation and adhesions. An effort was made to lengthen it by dissecting in one of its folds, with some success. The tear seemed to have extended from the long head of the biceps above to beyond the long head of the triceps below, but neither of these muscles was torn from its attachments. The margins of the capsule tear were then brought together by catgut sutures, the arm being brought toward the side of the body to slightly less than a right angle. The divided subscapularis was then sutured with catgut, and the skin with silkworm gut. No effort was made to close the pouch under the coracoid process, and now separated from the normal joint, except by the pressure of a good-sized gauze dressing in the axilla with the arm bound to the side of the body in a Velpeau dressing. A week later, when the stitches were removed, there was considerable pain under the pectoralis major and below the coracoid process, and a slight rise in temperature. A collection being suspected in the extra-articular synovial pouch, a probe was passed through the newly healed wound and an escape of serous blood followed, which soon clotted. A small drainage tube was left in two days. There was no packing of the wound afterward, and no further trouble. (See Figs. 4 and 5.)

The patient left the hospital on the thirteenth day. All bandages were removed and a leather brace was substituted a week later. There was already considerable movement in the shoulder. In the fourth week he was permitted to use the arm as much as possible

without undue strain. In the sixth week the masseur was permitted to use forcible movements, and in two "treatments" he was able to place the arm in the vertical position in abduction with the arm alongside the head. The patient could hold it in this position by supporting it with the other had.

October 14, 1908, nine months after operation, the patient had the full use of the affected arm and shoulder, in active, outside work as a surveyor. He began to work one month after the operation, and was soon able to swing the sledge for driving stakes and to do other such work. During the last summer he swam about 700 yards in a large lake without being accompanied by a boat. In boxing, he can deliver almost as hard a blow with the right arm as with the left. He can abduct the right arm as fully as the left, without associated movement of the scapula. (See Fig. 6.)

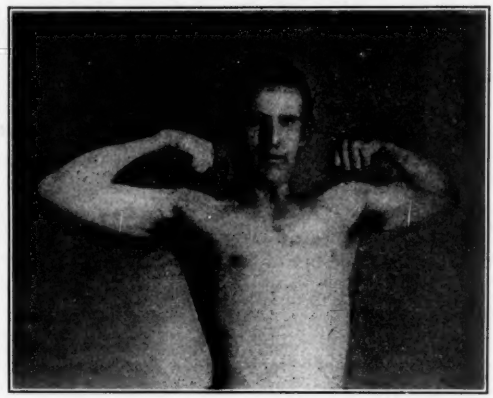

FIG. 4.—Showing atrophy of the biceps and deltoid of the right or affected side, six weeks after operation. The scar of the incision shows faintly.

CONCLUSIONS. Habitual or recurrent dislocation of the shoulder should receive more attention than has been given to it up to the present time, in view of the almost complete absence of statistics on the frequency of this condition, and the good results obtained from the operation of shortening the capsule.

The essential cause is a relaxation, due to the addition to the old, or original capsule, of a new cicatricial portion bridging over the gap between the margins of the tear in the anterior part, produced by the first dislocation. The numerous other causes which have been assigned to it probably have little or nothing to do with determining the recurrences, and require little or no attention at the time of operation, beyond the removal of loose fragments of bone. Although these have been discovered in relatively few cases, a more careful search for them may prove that they are more common than the literature now shows.

While recurrent dislocation of the shoulder has been known to undergo, apparently, spontaneous cure, this must be rare, and will always require many years. The result is even then very uncertain. Complicated shoulder braces may succeed in diminishing the number of recurrences, but only at the expense of much impairment of function and consequent atrophy of the muscles put out of action.

FIG. 5.—Illustrating a severe test of the ability of the repaired capsule to resist dislocation, six weeks after operation, *i. e.*, with the arm in marked abduction and the powerful adductor muscles of the shoulder in strong contraction.

The operation of shortening the capsule has been followed by success in 33 out of 34 cases collected from the literature, and in my own case. In only 1 did a recurrence take place, and in that case at the time of reporting the results the patient had had several epileptic attacks without another recurrence, although before the

operation he had been having them with every epileptic attack. His one recurrence took place in from three to four weeks after operation, and then from a degree of violence sufficient to have produced a dislocation in a normal shoulder. The condition is essentially a hernia of the joint, and the operation of capsulorrhaphy for the contraction of the capsule has given relatively as good, if not better, results than the Bassini operation for inguinal hernia.

Although, in all the 34 cases collected from the literature, the incision employed either divided the deltoid muscle or separated it from the pectoralis major, I believe that the axillary incision is

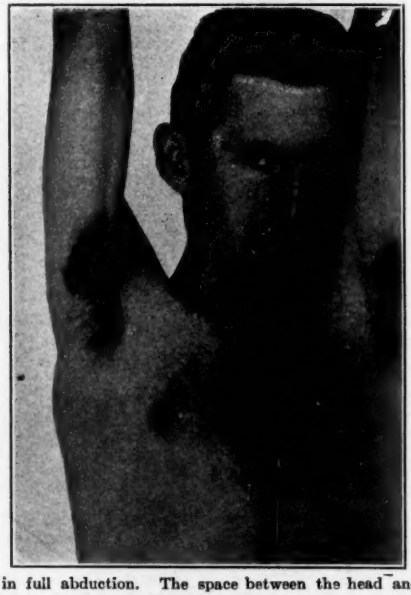

FIG. 6.—Arms in full abduction. The space between the head and the right arm is due to inclination of the head to the left side. Since this photograph was taken the scar has lost its rigidity.

better. By this route the deltoid is avoided, the site of the original anterior capsular tear and the resulting protrusion of the capsule are better exposed; the incision required is smaller, and if drainage should be necessary it would be dependent.

Judging from the results obtained by the various methods employed in the reported cases it would seem that an exact method of shortening the capsule is not important: although a folding of it by sutures without an opening in it, and therefore without intra-articular exploration, should be avoided, since a movable joint body, free or attached, may then be overlooked. The shortening may be provided by excision of a piece of the capsule and

uniting the margins of the opening by sutures, or by overlapping the borders of an incision made in the capsule. If the margins of the original tear are found, as in my case, they may be united by sutures.

I hope that this study of the subject will increase the confidence of the profession in shortening the capsule, as an operation quite sufficient for a radical cure, and that thereby many more sufferers from recurrent dislocations of the shoulder will find relief.

A RÖNTGENOGRAPHIC STUDY OF PERISTALSIS: THE RELATION OF WAVE FORM TO FUNCTIONAL ACTIVITY.

By Charles Lester Leonard, A.M., M.D.,
of Philadelphia.

Recent studies upon the living subject show that the normal stomach varies widely in shape and anatomical relations in different individuals. These normal variations differ entirely from the classical description of the anatomists. In fact, the physiological variations are so great that no type has been agreed upon as normal. The conclusion to be drawn is that the shape varies with the characteristics of the individual and that the stomach is normal which fulfils its functions perfectly.

The stomach is a freely movable, distensible organ, suspended at its cardiac and pyloric extremities. It varies in its size and shape with the amount of food ingested and the support given it by the other viscera under an intra-abdominal pressure exerted by the abdominal parieties. Its lower boıder and walls are freely distensible, while its lesser curvature is more rigid. It, however, changes its length and position in a remarkable manner even under normal conditions. It extends in length with an increased load, so that the pyloric end is often pushed far over to the right and curves back upon itself to the pylorus.

Deficient functional power may be present in stomachs that conform in shape to those having perfect function. Gastrectases, gastroptoses, and pyloroptoses have been described as pathological conditions. The significance of form can only be determined by estimating the functional efficiency in the individual case. This functional efficiency can only be determined by the ability of the stomach to empty itself in a given time.

Exclusive of newgrowths, ulcerations, scar-tissue contractions, and ptoses, gastrectases are the pathological conditions that most frequently interfere with functional efficiency. They may arise

from two diametrically opposed states. They are, on the one hand, the passive dilatation due to muscular atony and due to overdistention and lack of intra-abdominal support, and, on the other hand, dilatation with hypertrophy of the muscles caused by organic or spasmodic stricture of the pylorus. They are, therefore, sthenic and asthenic forms of gastrectasis, in which functional efficiency is defective, as shown by the residue of an ingested meal after the normal period in which the stomach should have emptied itself. The presence of this abnormal residue is determinable by employing the bismuth meal and the Röntgenographic method of examination. This, however, determines only a lack of motor efficiency, and does not differentiate between the sthenic and asthenic forms.

Is it possible for the Röntgen method to differentiate in any way between these two forms of motor insufficiency? The study of the stomach by the Röntgen method of examination has shown, in addition to the determination of motor insufficiency, variations in the size, shape, and position of the stomach. It has, in addition, determined the presence of newgrowths and scar-tissue contractions invading its lumen. The results of these studies upon the normal position and shape of the stomach and their pathological variations have been discussed at length by various authors, and will not be considered in this paper. This study is confined to variations in the form of peristaltic waves in their relation to normal and pathological conditions and their relation as a possible means of differentiating between the sthenic and asthenic types of gastrectasis.

Recent advances in apparatus and technique have made it possible to make instantaneous Röntgenograms of the stomach and intestines, which show some of the various forms of peristaltic waves under different normal and pathological conditions of the stomach. Although they are not as yet so extensive or complete as to justify absolute conclusions, certain deductions can be drawn with reference to the relation of peristaltic wave form to functional efficiency, which will aid in differentiating the sthenic from the asthenic pathological conditions of the stomach.

These studies show that there is a constant relation between the form and amplitude of the peristaltic wave and the amount of work to be accomplished, that the amplitude of the wave varies with the character of the food ingested, the position of the patient, and the amount of the gastric contents. They have shown that the amplitude varies in pathological conditions. The variations in sthenic and asthenic forms of gastrectasis are so distinct that apparently a differentiation can be made between gastrectasis due to a weakened musculature and that due to pyloric stenosis, whether organic or spasmodic. In the asthenic type the waves of peristalsis are practically absent when the patient is in an erect position and of but slight amplitude when the patient is prone or recumbent. In the sthenic

type the wave is of greater volume and less frequent, but particularly strong, when the patient is prone. The therapeutic value of rest after eating for all cases of motor insufficiency is thus demonstrated, since the waves are increased in strength.

The study of the peristaltic waves in the normal stomach under varying conditions in the kind and amount of food ingested shows that in the human subject the conditions are practically identical with those determined by Cannon in his classical studies on animals with the bismuth meal and fluoroscope. The difference between solids and liquids is seen not only in the stomach, but also in the œsophagus, boli of bismuth in bread and milk passing separately along the œsophagus, while bismuth in kumiss shows the entire shadow. The peristaltic waves vary in volume with the amount of food ingested, but are alike in type for the same kind of food, the shape of the waves differing when fluids or semisolids are employed.

When bismuth is taken in a glass of water the water is rapidly absorbed and the stomach is shown in its resting or nearly empty state, with a fine saw-tooth form of peristaltic wave. As the load increases, the amplitude of the wave increases, while its sinuous type persists. With semisolid contents, as bread and milk or rice pudding, the waves become less frequent with a greater amplitude, which shows that more work has to be done.

These characteristics are most prominent when the patient is prone, but retain their individuality of type when the erect position is assumed. In gastrectasis of the asthenic type all waves are practically absent when the patient is in the erect position. In the prone position they present the normal type, but are less frequent, while their decrease in amplitude shows the motor insufficiency. In gastrectasis due to obstruction the volume of the wave is more pronounced, though they are less frequent and are still more marked with the patient in the prone position, their increased amplitude showing that more work has to be accomplished.

The variations in the character of food ingested have not as yet been sufficiently great to determine the relative rapidity of their discharge from the stomach and passage through the intestines. They indicate, however, the possibility of further studies of great physiological interest.

One physiological fact, which had been suggested previously as possible, they have established, that is, that the stomach elongates to a marked extent during expiration. In one instance the difference in the perpendicular length of the stomach was one and one-half inches greater during expiration than in inspiration, while the base of the stomach remained at the same level. This motion may, in a measure, account for the ejaculatory expulsion of food from the pylorus which has been observed by some operators as distinct from the flow resulting from peristaltic action. Marked changes have

also been noted in the relation of the pyloric portion of the stomach to the pylorus itself, the stomach passing to the right beyond the pylorus and curving back upon itself.

The study of intestinal peristalsis has demonstrated differences in their character and in the shapes of their contents, but no segmentation, as described by Cannon in his observations on animals, has been shown. The peristaltic motion of the small intestine is so rapid that one-half second exposures are necessary to define sharply the fecal masses in the duodenum. Their shape differs entirely from that seen in the large intestine, indicating the presence of secondary waves of less volume. They apparently decrease in rapidity as the cecum is approached.

In the large intestine the subdivision of the intestinal contents is remarkable because of its completeness. This almost complete segmentation of the fecal masses, extending throughout the entire colon, indicates that the process of absorption continues throughout the entire colon. Various degrees of enteroptosis have been observed. That of the hepatic flexure is most common, and often includes the entire ascending colon, while ptoses of the splenic flexure and descending colon are rare. These ptoses seem to have little effect upon the motor efficiency of intestinal peristalsis, since the passage of the bismuth meal is apparently not delayed in cases in which they are present. They have, however, been found in cases suffering from intestinal indigestion, though their relation to this condition cannot be inferred, since they are found in other patients.

The plates to be shown illustrating these studies were made with an exposure of from one-half to one second. The meal employed was two ounces of bismuth, either subnitrate or carbonate, in water, kumiss, bread and milk, or rice pudding. Observations were made during the act of swallowing immediately after the ingestion of a part or the whole of the meal, and at intervals, one hour, six hours, and twenty-four hours after eating.

The accompanying plates illustrate the varying phases of peristaltic motion in some of the cases upon which this paper is based. Many of the patients presented marked gastric and intestinal symptoms, but those in which no motor insufficiency was present have been considered as normal in the type of peristalsis, since they did not differ from the normal cases studied.

The first illustrations show the difference between the passage of fluids and semisolids through the œsophagus.

Fig. 1 shows the entire œsophagus coated by two swallows of bismuth in kumiss. It was taken with the patient in the right oblique position, and shows the relation of the œsophagus in the mediastinum to the heart and spinal column.

Fig. 2 shows two boli of bread and milk with bismuth, passing down the œsophagus. The lower bolus is arrested at the dia-

FIG. 1

FIG. 2

FIG. 3

FIG. 4

FIG. 5

FIG. 6

FIG. 7

FIG. 8

FIG. 9

FIG. 10

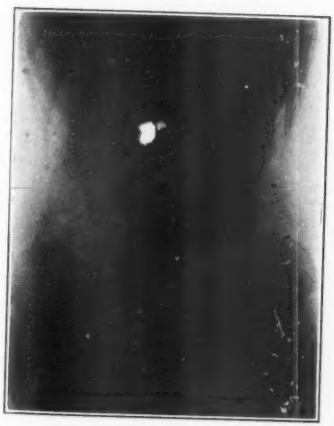

FIG. 11

FIG. 12

phragmatic opening, in which a small portion is seen as a dark line projecting downward through the diaphragm.

Fig. 3 shows a normal stomach in a state of rest, the bismuth having been given in a glass of water. The stomach in this instance has the form of a distended intestine, with a very fine saw-tooth type of peristaltic wave, indicating that very little motor activity is demanded.

Fig. 4. The stomach is here partially filled with four ounces of a bismuth and kumiss meal. There is a distinct "Magenblase" filling the cardia. An undulatory peristaltic wave of small volume shows on the greater curvature of the stomach.

Fig. 5. This is the stomach of a man aged fifty years, with two ounces of bismuth subnitrate in a half pint of kumiss. The undulatory character of the peristaltic wave with fluid ingesta is striking. The fluid media with the bismuth can be seen rapidly passing through the pylorus, the ascending, the descending, and the re-ascending limbs of the duodenum. The exposure in this case was one second, and was not short enough to show the peristaltic waves of the duodenum.

Fig. 6. The bismuth meal consisted of bread and milk, and the stomach is partially filled with the patient in the erect position. The level of the fluid in the stomach is clearly defined, with the "Magenblase" or gas-filled cardia above, while below the level of the fluid is a second line which corresponds to the upper limit of the denser portion of the meal. Single undulatory waves of peristalsis of slight volume are seen along the greater curvature.

Fig. 7. In this patient the bismuth was given in eight ounces of rice pudding. The peristaltic waves are seen to differ from those of the fluid meal, and are typical of the more solid gastric contents. The wave is seen to be deeper and single, showing on both the lesser and the greater curvature. The longitudinal rugæ are distinctly seen filled with the bismuth meal where the stomach has widened in its upper portion after the passage of the peristaltic wave.

Fig. 8 shows the gastric residue and intestinal contents six hours after the bismuth meal in a case of defective motility of the asthenic type. The weak peristaltic wave is seen in the stomach, though the patient was in the prone position. The entire small intestine is shown filled with the bismuth meal.

Fig. 9 shows the large intestine of the same case as Fig. 7 six hours after the ingestion of the rice pudding and bismuth. The distinct segmentation of the feces is noted throughout the entire colon. There is a complete ptosis of the ascending colon and hepatic flexure, carrying with it the transverse colon. The splenic flexure is seen in its normal place with gaseous contents, while an accumulation of gas is also seen in the cecum. This plate was taken with the patient in an erect position. In another plate taken in the

prone position about the same time there is no alteration in the position of the intestine, but the gas is absent from the cecum.

Figs. 10, 11, and 12 are from the same patient, and are of particular interest, because they show motor insufficiency due to pyloric stenosis, the result of ulceration and spasm of the pylorus, which was demonstrated by a subsequent operation. In Fig. 10 there is a marked peristaltic wave in the lower third of the stomach nearing the pylorus. It involves both the lesser and greater curvatures, and corresponds to what has been described as the "sphincter antrum pylori." A second commencing wave is seen between the middle and upper thirds of the stomach, while the perpendicular rugæ of the cardia and left side of the stomach are shown by the bismuth remaining in them as the stomach expands laterally. It should be particularly noted that the lungs are filled with air, shortening the saggital length of the stomach, while its base is at the iliac crest or a little below it. When this plate is compared with Fig. 11 of the same stomach, taken immediately after the other, but with full expiration instead of full inspiration, the contrast in the length of the stomach is easily noted. The base remains at the same level, only it is narrower, while the peristaltic wave, called the "sphincter antrum pylori," has disappeared, and a second wave is shown in the middle third of the stomach. In addition, a very small notch, on the outer border of the stomach between the upper and middle thirds, indicates the commencement of another peristaltic wave.

Fig 12 shows the stomach and intestines of the same patient six hours after the bismuth meal. The residue of the bismuth meal is shown in the lower part of the stomach with marked peristaltic waves. Bismuth is seen in the pylorus and the descending and ascending links of the duodenum. The greater portion of the meal has, however, passed into the cecum and the ptosed ascending colon, but the transverse and descending portions of the colon are empty. This is in marked contrast to the condition of the colon in Fig. 9, where the meal has passed into the descending colon in the same length of time. In this plate the gas-filled portion of the colon can be seen, and also very distinctly the spleen and lower border of the liver. The presence of this residue in the stomach shows motor insufficiency, but the character and strength of the peristaltic wave indicates no lack of muscular power, so that some form of obstruction was diagnosticated. The subsequent operation disclosed an ulcer near the pylorus with a spasmodic stricture.

INTESTINAL SAND: THE BANANA ONE OF ITS SOURCES.

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A careful perusal of the literature on intestinal sand brings one to a realization of the chaotic state of the entire subject at the present time: the symptomatology, the nomenclature, and the descriptions of intestinal sand are at present at great variance. Our attention was first directed especially to the subject by a case which we believed to be one of "true intestinal sand." Upon further study, however, we ascertained the real but extraneous origin of the sand, and at the same time we were led to the conclusion that the substance described in many of the cases owes its origin to the same or a similar source as that of our own. Contrary to the teaching of the French school especially, we do not consider intestinal sand a clinical entity nor productive of a definite train of symptoms. In arriving at these conclusions, we have endeavored to present as complete a bibliography as possible, and although some of the articles quoted may seem irrelevant, they have become so intimately interwoven with the literature in general that we deem it wise to record them here.

The sand in our case was of definite character, a finely divided material, and was passed by a young woman, aged twenty-four years, complaining of a feeling of intense fulness in the abdomen and chronic constipation. There was no gout or rheumatism in the family. The abdomen was tense and slightly tympanitic; there was a movable right kidney of the second degree; the stomach was in moderate ptosis, but otherwise negative. The feces were dark brown in color, firm in consistency, and contained a little mucus and fine granules resembling sand. One to one and one-half grams of this sand was washed from the feces daily. This sand was found in the motions for two weeks and then gradually disappeared. A nearer description of the substance will be given later.

We were at a loss to explain the phenomenon or to know in what relation the presence of the sand stood to the symptoms of which the patient complained. Nor did reference to the various text-books at hand tend much to enlighten us.

Emerson writes:[1] "True intestinal sand, of which we have seen but one good case, seems to be the result of a secretory neurosis of the intestine. It occurs in neurasthenic persons, and often in association with membranous colitis. Such stools are often pre-

[1] Clinical Diagnosis, 1906, p. 371.

ceded by about an hour of severe pain." Cohnheim[2] and Thompson[3] state that the term intestinal sand or sable intestinal is applied to the passage in the stool of sand-like particles of varied composition, usually composed of masses of vegetable material, such as the granules from the pear, the seeds of raspberries, blackberries, etc. Osler[4] writes similarly, and adds: "I have recently seen a case in which the patient on two occasions passed a considerable quantity of sand. The sample which he brought consisted of small grains, some of a beautiful garnet color. They proved to be vegetable matter." Anders[5] and Sahli[6] speak in this connection of hepatic calculi which have passed into the intestine, or earthy concretions or incrustations of food rests with earthy salts. Schmidt and Strasburger:[7] "The small concretions, which by the French authors go under the name of intestinal lithiasis, are often associated with membranous enteritis." Nothnagel[8] differentiates between the true and the false extraneous intestinal sand. He says that true intestinal lithiasis is nearly always associated with mucous colic. It has been regarded as due to a lithogenic catarrh of the bowel, and might be compared with the process which gives rise to the formation of concretions in the vermiform appendix. False intestinal sand may be of various kinds, but is usually the remains of indigestible vegetable food, which may or may not become encrusted with earthy salts.

The vague and meagre text-book references are out of proportion to the voluminous clinical reports on the subject, in which all manner of symptoms are cited and attributed to the presence of the sand. We shall cite here briefly a few of these reports in order to show that the present acceptation of the subject is based largely upon a popular fallacy which has been handed down from one author to another.

To Laboulbene[9] is justly given the credit of reporting the first cases of intestinal sand in 1873, under the title, "Les sable intestinaux." He reported cases in which he found a sandy substance (sable intestinal) resembling very much brown or yellow sand, which he believed to be of vegetable origin.

The next article to which we find reference is that of Biaggi.[10] Strictly speaking, this case bears no relation to that described by us, and we should not consider it worthy of mention in this connection were it not for the fact that the author considered the calculi a manifestation of a true diathesis, which hypothesis seems to have formed

[2] Die Krankheiten des Verdauungskanals, Berlin, 1905, p. 169.
[3] Text-book of Practical Medicine, 1902, p. 434.
[4] Practice of Medicine.
[5] Ibid., 1905.
[6] Klin. Untersuchungsmethoden, 1905, p. 455.
[7] Faeces des Menschen, 1903, p. 227.
[8] Encyclopedia of Practical Medicine, Intestines and Peritoneum, Amer. Edition, 1904, pp. 94 to 96.
[9] Bull. de l'acad. de méd., November, 1873.
[10] Presse méd. Belge, v. 26 (20), 19 avril, pp. 153 to 154.

the foundation for subsequent articles of French authors, in which this belief is prevalent. Marquez,[11] in 1879, reported a case of a woman with herpes, an arthritic disturbance, chronic catarrh of the large intestine, more or less pain, especial intolerance for vegetables and fruits, etc. In this case sand was discovered in the feces, which had the aspect of corpuscles, mostly granular, brown or some white. The sand was of irregular form, and some grains bristled with small crystals. Into their composition entered nitrogenous matter and to a marked degree mineral matter, containing 72 per cent. of organic matter and 28 per cent. of inorganic matter, mostly the carbonate and phosphate of calcium. The subject seems to have received no further consideration in the literature until 1895, when Monjour[12] describes the case of a young woman, "arthritic and neuropathic," with a mucomembranous colitis, obstinate constipation, and the presence in her stools of small gravel.

Fontey[13] presented a Bordeaux Thesis upon this subject. He states that under pathological conditions the intestinal mucosa may give rise to sand, and quotes the articles of Schoenlein[14] and Bellingham[15] in proof thereof. The former, in an epidemic of typhoid fever in 1835, found in the stools microscopic crystals of calcium phosphate and sulphate and a sodium salt, which he thought were constantly present in typhoid fever and of decided diagnostic value. The latter's case was one of bronchopneumonia, in which the postmortem examination showed great numbers of ammonium magnesium phosphate crystals in the colon. Oddo,[16] in 1896, reported the case of a woman, aged fifty years, with rheumatism, frequent attacks of urticaria, arrhythmic pulse, emotional spells of fainting, and painful intestinal crises. The stools were found to contain bodies of irregular shape, varying in size from a grain of sand to a small lentil. Mathieu and Richard[17] reported two cases in which the patient passed quantities of fine sand, of a dirty yellow or chestnut-brown color, in diameter from 0.25 to 1.5 mm. The authors express surprise at the frequency with which mucous enteritis existed in cases of intestinal sand which have come under their notice. Shattock,[18] in 1897, gives an excellent description of a case of intestinal sand under the title of "sable intestinal." The material consisted of small spheroidal grains of a pale brown color, which he thought were composed of compact groups of thickened vegetable cells, having the character of sclerenchyma extremely thickened by a succession of secondary deposits. The patient

[11] Assoc. Française pour l'avancement des sciences, 1879, p. 878.
[12] Compt. rend. de. la soc. biol., series 1, 1896, t. iii, 203.
[13] Thèse de Bordeaux, 1896.
[14] Arch. f. Anat., Phys. u. wissensch. Med., Berlin, 1836, pp. 258 to 261.
[15] Dublin Jour. Med. Sci., 1838, xiv, 278.
[16] Bull. et mém. de la soc. méd. des hôp., June 25, 1896.
[17] Ibid., 473.
[18] Trans. Path. Soc., London, xlviii, 124.

had suffered from hydronephrosis, and these cells were first mistaken for urinary calculi.

Dieulafoy[19] has presented one of the most exhaustive treatises on the subject, in which he recites a large number of cases. He lays the greatest stress upon the frequency of mucomembranous colitis, and believes intestinal sand to be a manifestation of a lithogenic diathesis, and therefore comparable with the kidney stone and tophus. The following is an abstract of one of his cases: A man, aged forty-eight years, gouty father. He himself gouty. Headaches, hemorrhoids, eczema, asthma, renal colic, with phosphatic calculi. Several years later a new phase developed. In the evenings the patient had pain in the right hypochondrium, spreading to the epigastrium and thorax. In his stools he found intestinal sand and mucus. It is important to note that on the day the intestinal sand made its appearance the pain about the kidney ceased completely. The author considers that these observations show the relation that exists between intestinal lithiasis and gouty diathesis, though he does not maintain that all cases are of a gouty nature. One can see that renal and biliary lithiasis are seen in the same individual at different times of life, or exist in the family as an hereditary manifestation.

Eichhorst[20] takes exception to the fact that the term "sand" is used indiscriminately for fine sand-like bodies, as well as for the large concretions. He thinks that intestinal sand is not a frequent occurrence, having seen only two cases in seventeen years. His first was in a woman, aged thirty-five years, who complained of obstinate constipation, which had not yielded to treatment. The grains were in every way like a sand when shaken up in a test-tube or placed under the microscope. In water the granules remained unchanged after days; also in alcohol and ether. The grains contained earthy carbonate salts, which upon the addition of mineral acids were seen to generate gas. As to the organic portion, two kinds were differentiated: one was composed of thread-like masses, which were held together by a transparent mass, the other was in all probability crystals of fatty acid. The next year Deetz[21] reported a case in a man, aged fifty years, who had symptoms characteristic of renal colic, and noticed sand-like bodies in his stool. The sand was hard, finely granular, and had a light or dark brown color. Saint-Phillippee,[22] in discussing the occurrence of crises of abdominal pain in children associated with constipation, states that in 50 such cases he has also found an intestinal lithiasis.

In the English literature, the authors have, as a rule, described fine sand-like substances, and not gravel or larger concretions. Bedford[23] gives the following description: "The sand was a very fine, granular, yellowish brown substance, very like fine sand, of which not

[19] Bull. de l'acad. de méd., Paris, 1897.
[20] Deut. Archiv f. klin. Med., lxviii, Heft 1 and 2.
[21] Ibid., 1901, lxx, 365.
[22] Jour. de méd. de Bordeaux, 1901, No. 49.
[23] Lancet, 1902, ii, 215.

more than one-half teaspoonful was passed at a time. Under the microscope the particles were of various shapes and sizes, oblong, oval, or irregular. The color varied from black, through reddish brown, to light yellow. Many of the granules were translucent only at the edges, and had no appearance of vegetable or crystalline structure. The organic portion amounted to 60 per cent." The same year Duckworth and Garrod[24] reported a case in a woman, aged thirty-three years, who had an attack of persistent diarrhœa lasting for three or four months. The stools contained oblong, rod-shaped, or irregular granules, 0.05 to 0.2 mm. long, varying in color from yellow to brown, some translucent, others opaque, except at the edges. The organic portion amounted to 40 per cent. Mitchell[25] reports a case of a man, aged forty-two years, who passed a pale brownish sand while on an exclusive milk diet. Ferguson and Thompson[26] have reported the case of a lady, aged thirty years, with moderate dilatation of the stomach, and at times decided neuroses approaching hysteria. In one of her periodical gastric attacks, she was given milk and lime water, and during this time a considerable amount of sandy matter was discovered in the motions. The sand was passed regularly for several months. It sank rapidly in water, presented a brownish yellow appearance, strongly suggestive of uric acid, and when examined microscopically the resemblance was striking. However, the murexide test was negative. Tierlinck[27] recently reported a case occurring in a woman, aged thiry-eight years, who had very painful abdominal crises, localized along the colon. The stools revealed the macroscopic presence of intestinal concretions of greater or less amount with much mucus.

When we survey the various descriptions of the intestinal sand in the articles we have just reviewed, it seems that we may separate them roughly into three classes: (1) Those in which the material really resembled fine sand-like granules, ranging in size from 0.15 mm. up to 1 or even 2 mm.; (2) those in which the word gravel or calculus more nearly suits the description than the word sand, the objects varying from the size of a lentil to that of a pigeon's egg or larger; and (3) those in which the description of the material itself is so indefinite that we can only infer that in using the term intestinal sand, the author had before him some sort of intestinal concretion resembling those of either class 1 or 2. We shall, therefore, confine ourselves to a consideration of these first two classes. When we examine those cases in which the "sand" is large as orange seeds, the question at once arises, Are these not ordinary fecal concretions? Biaggi describes balls 6 to 8 cm. in circumference, composed of ammonium magnesium phosphate, plant hairs, cells, etc. Oddo describes bodies varying in size from a grain of sand to a lentil,

[24] Lancet, March 8, 1902; Medico-Chir. Trans. 1901, lxxxiv, 389.
[25] Trans. Coll. Phys. Phila., 1903, xxv. [26] Jour. Path. and Bact., 1900, vi, 334.
[27] Bull. soc. de méd. de Gand., 1907, lxxiv, 96, 97.

with 28 per cent. fatty material. Most certainly this seems to be nothing else but inspissated fecal matter. In fact, Dieulafoy, in one of his cases, gives the following analysis of the concretions: Water, 11.25; fecal matter, 22.60; phosphoric acid, 17.56; calcium 26.22; magnesium, 14.05; silica, 5.68. It is true that this shows a somewhat greater proportion of inorganic salts than we would expect in ordinary fecal material, unless the patient had taken considerable milk.

When we turn to look at those cases coming under the first class, small sand-like grains, we are confronted with a puzzling variety of materials of various description: grains 0.2 to 1 mm., with irregular crystalline projections, accompanied by unaltered vegetable cells thickened by secondary deposit, which measured from 0.5 to 1 mm., and had been diagnosticated as renal calculi (Shattock). In the first case of Eichhorst the sand was "like urinary sediment." Duckworth and Garrod describe grains 0.05 to 0.2 mm., containing 60 per cent. ash, some of which was carbonate. These authors also distinguish between "false" and "true" sand, that which contains a nucleus of vegetable cells, or fruit seeds, such as Delepine and Verco have described, and that which (supposedly) has no such origin and is mostly composed of inorganic salts. Bedford also makes the distinction between "true" and "false" sand, and says that true sand contains a much higher percentage (28 to 70 per cent.) of inorganic salts than the false variety, except "in the case of the calculi produced in the intestines of people fed upon bread made from oat bran, which often contains from 60 to 70 per cent. inorganic matter." It seems more reasonable to believe that when the sand contains a large amount of mineral salts the cell or cells which had formed the nucleus are overlooked, and the sand is "true" sand; when the deposit has not been so great, the vegetable structures may be seen, and it is then considered "false" sand. Granted, perhaps, that there were such a thing as true sand, formed by an excretory process of the intestinal mucosa, we would still be at a loss to explain the 30 to 70 per cent. of organic matter which this true variety contains, for the ordinary organic constituents of the body, calculi, urea, cholesterin, uric acid, etc., are all absent. Delepine,[28] who has described specimens of "sable intestinal" which were formed by cells from the pear and various seeds coated with salts, calcium carbonate, phosphates, and oxalates, says, "It is only when these seeds are retained some time in the bowel and have time to become covered with calcareous matter that their presence is of interest to pathology." This statement becomes more significant when we notice that in the cases of Mathieu and Richard, Eichhorst, Ferguson, and Bedford, who give a high inorganic content for the sand, the patients suffered from "habitual constipation." Verco[29] found

[28] Trans. Path. Soc. London, 1890, xli, 111.
[29] Australasian Med. Gaz., Sydney, 1904, xxiii, p. 300.

in the stools of one of his patients small sand-like particles which he found later were the cells of the pear with calcareous coating, which consisted of carbonates and phosphates.

As to the various clinical manifestations which have been mentioned in relation to intestinal sand, we believe them to be largely unrelated and accidental, except as to the role constipation may play. However, it does not seem at all strange that gastro-intestinal symptoms have been encountered in practically every case reported. Physicians in general do not make a habit of examining the feces of every patient irrespective of intestinal symptoms, and it is only when such symptoms exist that they feel it necessary to note the character of the stool. The immense number of times that intestinal sand is present without some concomitant gastro-intestinal trouble is not taken into account. As to the importance of mucous colitis as an etiological factor, since this is the disease par excellence in which an examination of the stool is always made, in which the diagnosis is directly dependent upon such an examination, we need not be surprised that intestinal sand has been found in some of these cases. That it is not present in a majority, or even in many cases, does not need to be proved. We shall not deal with the great variety of other factors which have been brought forward as having an etiological bearing upon the subject. However, to show to what extreme this speculation has gone, we might cite the remarks of McNamara[30] and Renshaw,[31] who suggest that the excretion of sand is a reversion in the mammal to the egg-shell-forming function of the bird, and Bernhang,[32] who thinks that just as discharges of meconium in certain presentation of the fœtus subpartu is to be viewed as a signum mali omnis, so would he consider discharges of intestinal sand as a sign of the patient's being in greatest danger of life.

We wish now to go somewhat more definitely into a description of the sand in our case, its origin, and possible relation to the cases already cited: Upon macroscopical examination the stool was seen to be full of small black or brown sand-like granules, intimately admixed. The stool was washed through a fine sieve, and both the wash water and the residue were carefully examined. The greater amount of sand was to be found in the wash water, a dram or two being obtained from each washing. It has a brownish, sandy appearance, and feels gritty when taken between the fingers. Under the microscope the sand is seen to consist of irregularly shaped grains, varying in size from 0.05 to 0.2 mm., approximating more or less the oval form (Fig. 1.) They are translucent, but not transparent, and vary in color from a light yellow to dark yellow, brownish and greenish yellow, and many of them are of the color of uric acid crystals or garnets. When viewed by reflected light, the grains have a beautiful appearance, resembling a collection

[30] Brit. Med. Jour., 1903, i, 311.
[31] Ibid., p. 666.
[32] Deut. klin.-therap. Woch., 1906, iii, 428

of varied colored quartz. The grains are hard and brittle and are crushed with great difficulty under the cover glass. In one specimen which we obtained, concentrated acid caused the evolution of gas, and the sand became a much lighter yellow. Boiling water, alcohol, ether, chloroform, and dilute acids had apparently no effect upon the granules. The murexide and sodium hypobromite tests were negative.

We are indebted to Dr. Wm. H. Warren, of Washington University, for the examination of a single specimen of sand, in which he found 17.2 per cent. of moisture, after the extraction of which there remained 95.8 per cent. of organic matter. The nitrogen determination (Kjeldahl) yielded 2.5 per cent. The inorganic portion was found to consist mainly of phosphate of calcium.

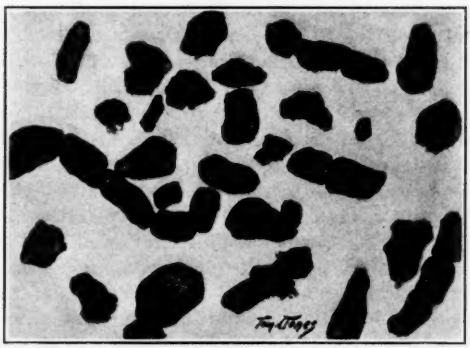

FIG. 1.—Intestinal sand obtained from the feces twenty-four to forty-eight hours after the ingestion of a banana.

We had arrived at the conclusion in our own minds that this sand was of vegetable origin, because of the high organic content, the regularity of shape and size of the grains, etc., but were laboring under the false impression that they were cellulose remnants, which through a prolonged sojourn in the intestine became permeated with certain insoluble salts, whose origin we were unable to explain. We felt the more certain of this upon finding in a single specimen of feces from a child several chains of sand, identical in appearance with the grains found in our first case. We endeavored, through the ingestion of various vegetables, to produce sand artificially, but were not able to do so. While making a routine examination of a specimen of feces, our colleague, Dr. Wm. Rush, called our attention to a chain of sand, together with two or three fibrovascular bundles having their origin from a common point and separated by a mass of parenchyma cells. It was suggested by him from its histological structure that this might be a remnant of the tissue of banana, and this it proved to be. Following this suggestion, we

were able to produce, ad libitum, sand identical with that found in our original case and apparently identical with that described by various authors, and to which a long train of symptoms were attributed. Through eating one or two bananas and examining the feces twenty-four hours later, intestinal sand may be found in teaspoonful to tablespoonful quantities, and may be found for several days afterward, diminishing gradually. In case of constipation, it may be found for a much longer period. The grains are found singly, as a rule, but also in chains if the stool is not manipulated too much in the process of washing. The discovery of the banana as a cause of intestinal sand enabled us to examine the literature from another standpoint, whereupon we met with the following references: Bates,[33] in 1887, published a paper entitled "Intestinal Concretions Resembling Sand and Originating in Cells from the Banana," in which he described these same small, organic, sand-like cells which he had washed from the stools of a child suffering from habitual constipation and attacks of gastric colic. He

FIG. 2.—Transverse section through the ripe banana treated with a 10 per cent. aqueous solution of ferric chloride, showing the pansy-like arrangement of the milk tubes.

had shown these cells to a great number of physicians, without being enlightened as to their origin, when Edes[34] recognized them as of the same origin as those he had described. Edes was also led to the proper interpretation of the banana as the origin of the sand, by the fact that some of the undigested banana tissue accompanied the sand-like cells.

If the banana is sectioned transversely and exposed to the air for a time, light brown markings appear on its surface, radiating from the centre toward the periphery, where they turn to form an arch with an adjacent line. If certain substances are poured upon its surface, such as ferric chloride, which acts very rapidly and decidedly, these markings are beautifully brought forth (Fig. 2). They stand out as black chains or strands embedded in the tissue of the banana. Under the microscope these are found to be identical with the grains and chains of sand found in the feces of those ingesting bananas, but are not so hard. If one obtains a thin section of the banana, or

[33] AMER. JOUR. MED. SCI., 1887.
[34] Boston Med. and Surg. Jour., May 10, 1883.

strips off one of the long longitudinal strands from the inner side of the peeling, and treats this with ferric chloride, the chains are found to be made up of small masses of a garnet-colored substance, each contained within a cell membrane. The garnet-colored bodies are evidently the contents of the cells (Fig. 3). If examined in a fresh state, unaffected by chemical agents, these cells are found to be chains or threads of homogeneous bodies united end to end, soft enough to be influenced by pressure upon the cover glass, which causes them to burst and exude a gelatinous, colorless mass. The chains run in pairs, surrounding the fibrovascular bundles. In the botanical literature, put at our disposal by Professor W. Trelease, of the Missouri Botanical Garden, were found but few references bearing directly upon the subject. In Engler and Prantl[35]

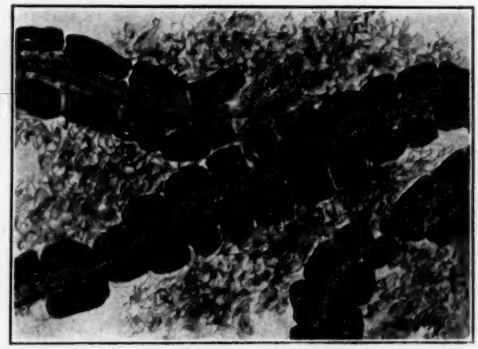

FIG. 3.—A small portion of a banana treated with a 10 per cent. aqueous solution of ferric chloride (magnified 70 diameters), showing double chains of milk-tube cells accompanying the fibrovascular bundles, with parenchyma cells intervening.

reference is found to the milk tubes in the Musa, which consist of cylindrical rows, one above the other, of cells rich in tannin. De Bary[36] refers to jointed milk tubes (gegliederte Milchröhren) produced by end to end fusion of cells, and says: "In the stem, as well as in the fruit, the vascular bundles are accompanied by milk tubes two to six in number, symetrically arranged and separated from them by one or two layers of parenchyma cells. . . . These milk tubes consist of a row of vertical cylindrical cells, one above the other, four times as long as they are wide, and through a round wide opening at each end are converted into a continuous tube. They contain large homogeneous, highly refractive resin balls or masses, suspended in a fluid very rich in tannin."

These resin balls, then, the contents of the cells, suspended in a fluid rich in tannin, are affected by the secretions of the stomach

[35] Die Natürlichen Pflanzenfamilien, 1889, ii, 6.
[36] Vergleichende Anatomie bei Phanerogamen und Farne, 1877, pp. 153, 160, 451.

and intestine in a manner similar to the action of the ferric chloride, hardening the resin and producing an insoluble tannate. The cell wall is digested or destroyed, and the hard resin-tannin-containing mass is liberated as a grain of sand. The extreme hardness of the grains found in the feces is due evidently to the prolonged influence of the secretions and salts in the intestinal canal, and the color to a tannate formed, influenced perhaps to some extent by other coloring matters in the intestines. We were unable to give the same hardness to the sand produced artificially outside of the body through treating it with hydrochloric acid and pepsin, saliva, pancreatin, ferric chloride, or by mixing it with the feces, etc., though nearly all of these agents hardened the grains to a certain degree and gave to them the typical color. Thus far, we have been unable to find other fruits or vegetables which give rise to similar bodies.

That intestinal sand may be produced through the ingestion of the banana has been proved by us beyond a doubt; that the descriptions of the sand reported in the literature by some authors seem identical with ours is certain; that many of these were due to the ingestion of the banana, or some other fruit or vegetable having like structure, seems most probable.

GENERAL AND SPECIFIC RESISTANCE TO TUBERCULOUS INFECTION.

By Karl von Ruck, M.D.,
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Before discussing general and specific resistance to tuberculous infection, I wish to refer briefly to infection in general. Omitting much that would perhaps be relevant to a fuller elucidation of the subject, I may state the accepted fact that a bacterial invasion of a living organism can occur only when the related bacteria find conditions favorable to their life and multiplication within its tissues, and that the action of their toxic products depends upon a receptivity for them by the component tissue cells. The primary effect and the course of such an infection may be influenced or modified by the bacteria themselves: first by the number of living units which have gained entrance, and, second, by their life energy and their adaptation or virulence for the particular species of animal. The character and function of the tissue in which the growth and multiplication of the bacteria takes place, and in any case their biochemical properties have a determining influence.

When an infection has actually occurred, one of three things can happen: (1) The bacteria may be destroyed; (2) they may

continue alive, but are prevented from growing and multiplying; and (3) they may grow and multiply and in due course of time produce their characteristic effects. In such a case a small number of living bacteria would be of but temporary influence, the evolution of the disease could for a time be slower, but so long as growth and multiplication is possible, the disadvantage of a small number would in time be overcome when new generations have formed, and these would likewise be free from the effect of a check in vitality which might have occurred to the bacteria which were primarily concerned in the infection.

Virulence is so closely associated with growth and multiplication and the latter with the nutritive soil, that many observers consider growth-energy and virulence to be identical. That the composition of the soil is of importance is well known from experience in the artificial cultivation of pathogenic bacteria, although this permits of a materially greater variation than is likely to be present in the tissues of the same species. When we nevertheless observe it in the latter, it is because we deal with a living soil, which is subject to influences of a biochemical nature; and in addition to *substance*, we are obliged to take into consideration *vital functions* of a very complex nature. These functions are of cellular origin and can be general or special; in their general aspect they are intimately related to cell nutrition, and in their totality and integrity they constitute the normal manifestations of life.

Some of them are regulative and thereby protective in maintaining a properly adjusted balance. Minor disturbances, and especially such as are frequently repeated, are adjusted automatically and rapidly enough for the individual to remain unconscious of their occurrence. Others, of a severer degree, and especially such as are unusual or entirely new, manifest themselves in what we call disease, and then the restoration of the balance may occur more slowly or it may fail. This depends upon the nature and degree as well as upon the duration of the disturbing factors, and in infectious diseases latent cell functions may become active, or apparently new functions may develop to aid in the restoration of a normal equilibrium.

These general principles apply to all disturbances of normal life conditions, and those which are produced by pathogenic bacteria conform to the same general laws. The fact that our understanding of these laws is often only fragmentary and, therefore, greatly limited, does not justify their denial, even though we see apparent contradictions. Many such have in the past confronted human inquiry on other subjects, and often in simpler propositions than in those pertaining to the study of the phenomena of health and of disease; and some of them have finally found their elucidation upon these same primitive principles. All such studies required in the first place the formulating of theories, and for the origin of tuberculosis the theory of its direct inheritance or of a

special inherited predisposition is but natural for the time in which it was evolved. When theories, however, do not find support in observed facts, or when new facts are discovered with which they cannot be brought into harmony, then they require reconsideration, which may necessitate modifications or their entire abandonment.

Such reconsiderations have engaged the attention of many able students of tuberculosis, especially since the actual demonstration of the strictly infectious nature of the disease as a new fact, and the study of immunity since then has added other facts which I believe to be out of harmony with some of our former views and with accurate clinical observations.

The latter have shown that good preëxisting health and a perfect family history by no means protect against the acquirement of tuberculosis or even modify its course favorably, and the evidence is growing stronger that impairment of health before the outbreak of the disease depends frequently upon a tuberculous infection which, by its hidden localization or by its earlier insidious progress, was overlooked.

The enormous tuberculosis mortality among primitive peoples, when once they are exposed to infection, in whom we see likewise the least resistance in its course, is also significant and supports the view that individuals and races are primarily non-resistant and that subsequent generations develop previously latent or new protective functions which become efficient in proportion to the frequency with which they have been exercised in the ascendants. For the lack of resistance in such primitive peoples to tuberculosis I need but cite the observations collected by Hirsch[1] in regard to negro and other races in their native countries, and those which have been made on the negro and Indian population in the United States.[2] The interested student will find additional data in the publication by Reibmayr,[3] not only for comparison of prevalence and mortality in aboriginal races before and after the advent of tuberculosis among them, but also evidence that the frequency and fatality of the disease decreases in civilized races, accordingly as they have had to contend with the disease for longer or shorter periods of time. Reibmayr's data are supported by similar studies by Marengos,[4] Fishberg,[5] and others upon the Jewish race; and although the presumed resistance of the latter is no doubt often overestimated and may be variously modified and lowered, the correctness of the claim of their greater resistance, becomes apparent when their mortality and morbidity from tuberculosis is compared with that of peoples who have more recently come under the influence of the disease and who are otherwise living under similar or even better conditions.

[1] Historisch-Geographische Pathologie, Stuttgart, 1886, iii, 156.

[2] Martin, Trans. Nat. Tub. Assoc., Washington, 1906, p. 91; Jones, Ibid, p. 97; Harris, Jour. Amer. Med. Assoc., 1903, xli, 834; Adams, Medical Record, 1907, xxxiii, 833.

[3] Die Ehe Tuberkulöser und ihre Folgen, 1894, 35.

[4] Grèce médicale, October, 1901.

[5] Amer. Med., 1901, ii, 695.

A recent study by Woods Hutchinson[6] shows, among certain tribes of American Indians, a tuberculosis mortality of from two-thirds to three-fourths of all deaths, and this author, like Effertz[7] and many others, calls attention to the rapidly fatal course of the disease among the Indians from which previous robust health and physical vigor was unable to protect.

The observations of Johnston[8] of a difference in morbidity of 60 to 65 per cent. as between European and native troops in the British army in India, and the records of 290 deaths from tuberculosis per 1000 hospital admissions in the Egyptian army recruited from natives, as shown by Captain Cummins[9] cannot be well explained upon any other theory than that Europeans are possessed of a certain degree of racial resistance. On the other hand we have all observed more or less numerous instances of long continued exposure with apparent escape from infection or of a favorable, or an extremely chronic course of the disease, in individuals whose physical and general condition was anything but indicative of a strong constitution or vigorous health; and in studies of the influence upon prognosis of a tuberculous family history nothing has been shown to indicate that it interferes with the prospect for arrestment of the disease or with recovery.

The freedom from tuberculosis of races and peoples that had as yet not been brought in contact with the disease was at one time considered an evidence of their immunity, but the error of this view has become apparent enough; and instead, it has been found that their effective exposure is followed by infection with almost mathematical certainty, and when this occurs through contact with tuberculous individuals whose disease follows an essentially chronic or favorable course, they, themselves, develop a most virulent and fatal type, showing that the virulence is conditioned by the new soil and not by its variation in the bacillus. Maffuci[10] has been able to demonstrate the difference experimentally in chicks. When they had a tuberculous parentage, their infection was followed by a chronic form of tuberculosis with a tendency to recovery, whereas in those of healthy parentage, the course of the infection was acute and rapidly fatal.

The comparatively lower mortality from tuberculosis in peoples who have long battled with the disease was evident long before the introduction of modern methods of public and private hygiene. In the British Isles, for instance, a gradual reduction is shown as far back as we have reliable statistics. Similar observations have been made in other European countries, and they indicate the operation of the law of adaptation by which individuals and races increase their resistance to agencies which act destructively and threaten their

[6] Trans. Nat. Tub. Assoc., 1907, 191.
[7] Wien. klin. Woch., 1904, xvii, 129.
[8] Brit. Jour. Tub., 1908, ii, 20.
[9] Ibid., p. 35.
[10] Rend. R. Accad. dei Lincei, Roma., 1903, xii, p. 421; Zentralbl. f. Bakt., 1904, xxxiv, 708.

extinction, and transmit it to their posterity. Among their posterity there must necessarily occur differences and oscillations, and in unions in which one member possesses a less degree or none at all, the offspring's resistance represents but the average. In the negro race in the United States, which has suffered severely from tuberculosis during the last fifty years, the course has become less severe, and the chronic type is now observed much more frequently than twenty or twenty-five years ago. In more recent years I have observed latent forms more often than formerly, and recoveries are no longer such rare exceptions as they were at that time.

The special resistance which has thus been transmitted may gradually disappear in subsequent generations, when the defensive functions have not been exercised, or when they have become impaired by an unhygienic mode of life, or actual disease. We see this illustrated in families in which the disease skips one or more generations, only to appear again in the next.

Higher degrees of specific resistance to tuberculosis in man must be accepted in instances of latent infections and in those in which the disease appears to have been promptly arrested in its early incipiency. Such latent infections have been discovered by Loomis,[11] Pizzini,[12] Kaelble,[13] Harbitz,[14] Weichselbaum and Bartel,[15] Spengler,[16] and others, and the tubercle bacilli, though apparently without power of pathogenic action in the individuals in whom they were found, were nevertheless shown to possess it, in the animal experiment. The frequency with which these authors found such latent infections at autopsies in which no evidence of tuberculosis could be shown, and the studies of Perez[17] and of Manfredi and Frisco[18] preclude the assumption that the bacilli had been deposited so recently that they had as yet not time to produce their characteristic tissue alterations.

The assumption of a specific resistance is justifiable and more rational for the interpretation of some of the minute non-progressive or obsolete and healed tuberculous lesions, which are so frequently found accidentally at autopsies and so often described in literature, that I need not cite particular statistics. In many such cases the nature of the lesion was confirmed by animal inoculation, showing, as in the instances of latent infection, that the bacilli had retained their virulence. More remarkable still are examples of extensive eruptions of tubercle, even of generalization in important organs, that have followed an apparently latent course. I refer more particularly to cases of generalized miliary tuberculosis in which no symptoms were produced until shortly before death, or in which a generalized affection was found accidentally at autopsy. Such

[11] Med. Record, 1890, xxxviii, 689.
[12] Ztschr. f. klin. Med., 1892, xxi, 329.
[13] Münch. med. Woch., 1899, xxxxvi, 622.
[14] Jour. Infect. Dis., 1905, ii, 143.
[15] Wien. klin. Woch., 1905, xviii, 241.
[16] Ztschr. f. Hyg. and Infktskr., 1893, xiii, 347.
[17] Zentralbl f. Bakt., 1898, xxiii, 404.
[18] Ibid., 1902, xxxii, 295.

cases were, for instance, reported by Hager[19] and by Kollick.[20] In the cases of Wunderlich,[21] or of Demme[22] the entire course of the generalized disease had been symptomless, until the mechanical, irritative, and pressure effects from the coexisting meningeal tuberculosis caused death in a few hours. A mild and entirely afebrile course of miliary generalization, in which the number of tubercles or the number of organs involved offered no adequate explanation, is likewise suggestive of a specific antagonism to the bacillary toxins. If we add to such unusual observations the frequently observed healed lesions mentioned before and the spontaneous recoveries from more advanced stages of local tuberculosis, often under adverse conditions, we have better reason to consider them as evidences of a high degree of specific resistance than to ascribe them to accidents, or to freaks of Nature in which her best students know that she does not indulge.

Much more circumstantial evidence might be added to strengthen this side of the argument, but the facts stated may suffice for the consideration of the theory that man, although protected in various ways against the access of tubercle bacilli to his tissues, is primarily not resistant to their pathogenic action after an entrance has once been effected, even though his tissues be normal. The theory denies that tuberculous ancestors transmit to their descendants a specific predisposition of their tissues, by which the development of tuberculosis is favored; on the contrary, it affirms that under the law of adaptation there has been evolved a protective mechanism on the part of the tissue cells. This protective mechanism and its function differ in degree of development, and, therefore, in efficiency, according as they have been exercised more or less frequently and constantly in preceding generations and have been preserved by a normal hygienic mode of life. In instances in which the antagonism of this function in insufficient to prevent the primary localization and pathogenic action of the tubercle bacillus entirely, it may still retard its growth and modify favorably the course of the disease, thereby permitting a further increase through the specific stimulation by the bacillary products, the same as we observe it in other infectious diseases.

Without such a defensive mechanism, infections could but progress, and eventually destroy the organism. When we find this otherwise, and improvement and recovery occur, we are constrained to ascribe the contrary course to the intervention of a newly developed or increased power of defense which is also shown by the formation of specific antibodies in the blood serum. The amount and rapidity of their production varies with the infected organism itself, and with

[19] Deut. med. Woch., 1881, viii, 557.
[20] Prag. med. Woch., 1901, xxvi; Cntrlbl. f. inn. Med., 1901, xxii, 606.
[21] Arch. f. phys. Heilk., 1859, iii, 283.
[22] Cited by Cornet, Nothnagel's Spec. Path. and Ther., Wien, 1901, Th. 2, Abth. ii, p. 41.

the biological characteristics of the related bacteria, and upon this variability depends, at least in part, the course of the disease.

When the required mchanism is present and its function is easily excited, when the amount of specific stimulation for this purpose is adequate but not excessive, then the organism protects itself promptly and efficiently; but when these conditions are not at all, or only partially fulfilled, the result varies accordingly. The mechanism and its functions are liable to be less perfected and less effective in localized infections like tuberculosis, in which the stimulus is inadequate because of the limited production and slow absorption of specific toxins from primarily small non-vascular foci; and, further, because the tubercle bacillus is but a slow grower, and is itself extremely resistant to disintegration. Under such conditions the resistance develops but slowly, and never attains as high a degree as it does in general infections. The influence upon the course of the disease is more frequently only that of a check clinically manifest by an intermission which lasts until a reduction occurs naturally in the course of time, or until adverse influences of a general nature and especially in nutrition have a like effect. Accessions and remissions follow thus, as we are accustomed to see them in the clinical course of phthisis, the former leading to further local impairment by advance of the disease.

The evolvement of this function for the species as a whole must of necessity be slow, and even the attainment of a degree capable of modifying greatly the severity of the disease process, to say nothing of protecting against the infection entirely, may require centuries. Whether or not such an influence is now apparent in most of the infections with which the human race has battled in the past, as some students believe, we need not here decide, but the claim of competent observers, that infectious diseases previously unknown among a primitive race are unusually severe in their course, is suggestive.

In tuberculosis of the negro race I am inclined to the belief that the amelioration in severity in the course of the disease heretofore referred to may be considered as an evidence that a specific resistance begins to manifest itself, and if we are justified to look upon specific agglutinins for tubercle bacilli as an evidence of it, my own observations of their occurrence in apparently healthy full-blooded blacks, as well as in mulattoes, would give support to this view. Landis,[23] in a recent publication, has shown that the increase of agglutinins in chronic phthisis of negroes corresponds to that of white people, and he likewise found them present in such, who were in apparently vigorous health. Studies of immunity in tuberculosis are of more recent date and not enough comparative observations between so-called predisposed and not predisposed subjects have

[23] Jour. Med. Research, 1908, xiii, 19.

been made to corroborate fully the views here expressed. The occurrence, however, of specific agglutinins for tubercle bacilli in the blood serum of not a few persons who are apparently in good health, and with more or less frequency in newborn infants of mothers who have no demonstrable tuberculosis, would suggest a transmission of immune substances, while their almost uniform presence in tuberculous subjects shows their formation under the specific stimulus of the disease.

In the regular examinations of our patients in the Winyah Sanitarium we have practically never failed to demonstrate agglutinins excepting in cases in the cachectic stage of phthisis, although like others we have never observed a high degree of agglutinating power to develop in patients who have not been subjected to specific treatment. In cases in which the reaction occurs in apparent health in older children and in adults, it is of course possible that it stands in relation to a latent or healed tuberculous lesion not demonstrable clinically; but this could hardly be the explanation in the case of newborn infants whose mothers have no evidence of this disease. Examinations for other immune bodies in such cases will undoubtedly bring additional light as to their transmission. Being present in but small amounts in tuberculous subjects, and, as a rule, in still smaller amounts in those who are in apparent health, we would naturally expect that when transmitted the amount must be still less, and perhaps so small that they would not be demonstrable by the method usually employed.

In newborn infants Rosenberger[24] never found complete agglutination in dilutions higher than 1 to 1, or 1 to 3. Of the 27 infants which he tested, 15 gave no reaction at all. With a different culture of tubercle bacilli the results in another series of 39 newborn infants were positive in a still smaller number, and the almost entirely negative results of Salge[25] and the negative results of Descos[26] and of Cavazza,[27] and the few positive results observed by Anderodias[28] may, in part, have been due to unsuitable cultures.

In 8 of Salge's nurslings who were under one year of age and in whom there was a suspicion of tuberculosis, the reaction was positive. So far as concerns newborn infants the accumulated observations show that in a minority of cases agglutinins in amounts sufficient for demonstration may be transmitted by the mother, even if she be clinically free from tuberculosis.

In infants borne by tuberculous mothers the reaction is present more often, but the opportunity for making such tests is not frequently afforded to those who are most interested. (Hirigoyen[29]

[24] Centrlbl. f. inn. Med., 1904, xxvi, 665.
[25] Jahrb. f. Kinderhlk., 1906, xiii; Schmidt's Jahrb., 1907, ccxcv, 75.
[26] Jour. d. phys. et de pathol. gén. 1903, v, 127; Baumgarten's Jahresber., 1904, xx, 571.
[27] Policlin. sez. prat. anno 11, fasc. 10; Baumgarten's Jahresber., 1904, 514.
[28] Soc. obstétr, Paris, 1903, Juin 26; Arch. gén. d. méd., 1903, ii, 1791.
[29] Gaz. hébdom. d. méd. et de chir., 1901, vi, 708.

tested one case and obtained a positive result.) In the two examinations made in my laboratory the mothers had been treated specifically to within several months of confinement, and their sera had at that time attained a complete agglutinating power in dilutions of 1 to 250 and 1 to 175 respectively. The serum of their babies' blood taken from the umbilical vein showed an agglutinating power in dilutions of 1 to 100 in the first, and of 1 to 80 in the second case. In the former the serum was likewise tested for specific amboceptor by Bordet and Gengou's[30] method and its presence was still shown in a dilution of one part of serum in 500, this having been the greatest dilution which was prepared. Thus it would seem that the degree of specific resistance as represented by the agglutinating power of the serum at birth bears a proportionate relation to that possessed by the mother during her pregnancy.

There is, however, reason to believe that transmitted immunity becomes diminished with increasing age; for this speaks for instance the communication of Bentzen[31] who found that of 26 nurslings not over four months of age, all of whom were exposed to measles, only 4 contracted the disease, while of 47 others exposed between the ages of five and eleven months 35 acquired the infection. Other observations upon the frequency of acute infectious diseases in nurslings have been similar. Mossé and Daunic,[32] Widal and Sicard,[33] Schumacher,[34] Hicks and French,[35] Staubli[36] and many others have shown the presence of specific agglutinins in the blood of infants born by mothers who during their pregnancy had suffered from typhoid fever; but most of the authors also found that they soon disappeared. Anderson,[37] and also Polano[38] have shown a similar relation experimentally in diphtheria; Figari[39] found immune bodies in the serum of the young of immunized goats, and these were further increased by suckling.

While agglutinins belong to the specific immune bodies, the one which is of greater importance for the demonstration of a true immunity is the so-called "amboceptor" which enables the germicidal part of the blood to act upon the foreign cells or bacteria, and although both are as a rule present in immune sera, the agglutinins may disappear, while the amboceptor function remains. Neither is there a necessary quantitative relation between the two, although both usually increase under active methods of immunization.

Until more recently my own studies were limited to specific agglutinins, the method for their demonstration being less complex, less difficult, and more rapid. My records of several thousand

[30] Ann. de l'Inst. Pasteur, 1901, xv, 289; Berl. klin. Woch., 1906, xxxxiii, 1531.
[31] Norsk. Mag. f. Laegevid., 1905, No. 7; Ctrlbl. f. inn. Med., 1906, xxvii, 17.
[32] Comp.-rend. Soc. d. biol., 1897, xlix, 238.
[33] Ibid., p. 804.
[34] Ztschr. f. Hyg. and Infktskr., 1901, xxxvii, 323.
[35] Lancet, 1905, i, 1491.
[36] Ctrlbl. f. inn. Med., 1905, xxvi, 464.
[37] Jour. Med. Research, 1906, x. 241.
[38] Ctrlbl. f. inn. Med., 1905, xxvi, 714.
[39] Riforma med., 1905, xxi; Schmidt's Jahrb., 1906, cxci, 63.

tests in approximately 500 patients examined show unmistakably that a high agglutinating power corresponds with a favorable course of tuberculosis. In more recent examinations for demonstrating the specific amboceptor, I have been able to show its presence in healthy persons with and without coexisting agglutinins, and have found that the amount may be large in tuberculous patients when the agglutinins are proportionally low in amount, and that like the agglutinins the amboceptor function can be increased under the administration of specific products of the tubercle bacillus.

I must now recur to the question of general resistance and consider its importance, which I may appear to have neglected. I have, however, indicated that the formation of immune substances is a cell function, and as this depends again upon normal cell nutrition it is apparent that the general health of the individual is not a negligible factor either in prophylactic hygiene or in the treatment of the actual disease. The integrity of the natural external protective agencies by which access of the tubercle bacillus to the tissues is hindered or prevented, likewise depends upon it. Disturbances of nutrition may, therefore, suspend or lower the specific resistance, and when continued, may cause its complete loss. Such observations have been made in experimental infections, when by starving, exposure to cold, poisoning, etc., animals naturally immune to a given infection have been made to succumb to it.

Normal nutritive processes have an opposite effect in favoring the elaboration of protective substances or preventing their loss, which is especially observable in chronic infections, both by experiment and clinically, and our system of general dietetic and hygienic treatment of tuberculosis rests upon these principles. Von Hansemann[40] has shown that they apply to plant life as well, by observing the difference between a poor unsuitable soil and a good one upon parasitic infection, the parasites disappearing spontaneously when the nutrition of the plants was improved.

Thus in the individual case in which the organism resists the infection or the progress of the disease, the lowering of the nutritive function may, and frequently does, disturb the balance in its favor, while an added improvement or the recovery of the lost balance acts in the opposite way.

The theory of specific resistance, as a substitute for a specific predisposition, tends to show that under the law of adaptation and the survival of the fittest, tuberculosis has in the course of time been changed from a rapidly progressive and usually fatal, to a chronic and more often self-limited disease, and that this is chiefly due to the development of a specific defensive apparatus against the tubercle bacillus and its toxins.

Inasmuch, however, as the efficiency of this apparatus is modified

[40] Die Deutsche Klinik, 1903, i, 665.

by its use or disuse and by the general nutritive integrity of the organism, it follows that there is little if any prospect that the disease will naturally disappear even in remote periods of the future, the less so, as, by reason of its local character, a high degree of immunity is never likely to be attained, because when effective enough to protect fully against infection in one generation, it will fail, by disuse and by unhygienic modes of life which lower it, to do this in succeeding generations. The disease must, therefore, fluctuate in frequency and severity, with perhaps a tendency on the whole to a more benign course. Reibmayr believes that upon these principles and with the aid of a better hygienic mode of life the human race must eventually work out its own salvation.

Studies in immunity since he wrote his treatise entitle us to hope that this may be anticipated by protective vaccination against tuberculosis, through which the attained resistance of the individual may be maintained and further increased. That in the manifest disease the therapeutic application of the same principle will greatly aid in securing actual and lasting recoveries, I believe to have amply demonstrated with others in the past seventeen years, since Professor Koch introduced his first crude tuberculin for this purpose. The value of this aid, although disputed and discredited by many observers, I learned to recognize in the first years of my work, and upon purely clinical observations the conviction was forced upon me then, that the action of tuberculin when properly applied was one of active immunization, limited in efficiency chiefly by the crudeness of the remedy and by the advance of the disease and coexisting complications.

Since then better preparations have become available and methods have been discovered by which their immunizing action can be shown in blood studies, which enable the observer to witness the development of immune substances and their increase to a degree which, in well-selected cases, soon exceeds manyfold that which has been shown to occur spontaneously under the much slower, and, as a rule, inadequate self-immunization through the same product derived from the bacillus and absorbed from the diseased tissues. Such studies and the permanency of clinical results have overcome the distrust in the method and have converted opponents into active supporters, and they have given a new impulse to specific treatment to a degree that I fear will once more lead to unjustifiable expectations.

Very little has as yet been attempted in the prophylactic use of specific products from which I am convinced their greatest benefit will eventually accrue, especially when we can find a still more effective vaccine and on that account also a quicker method. It is, however, quite possible that in subjects not as yet tuberculous, the present comparatively slow method can be greatly shortened, and experience must show to what degree prophylactic immunization

must be carried to assure protection against ordinary modes of infection. In the meanwhile the early glandular tuberculoses of young children, and the prophylactic application of the present method in those known to have been exposed, offer an attractive field, and in such and similar cases I have in the past seen most favorable changes in the general health and improvement in retarded physical development under specific treatment.

A CLINICAL STUDY OF THE EFFECT OF TUBERCULIN TREATMENT ON THE SERUM AGGLUTINATION OF TUBERCLE BACILLI.

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(From the Saranac Laboratory, Dr. E. L. Trudeau, Director.)

For several years the agglutination of tubercle bacilli by human blood serum has been investigated in the Saranac Laboratory, not only to see if the agglutination test is of value in the diagnosis of tuberculosis, but also to determine if the test can be used as a control during the course of tuberculin treatment. In a previous communication[1] we have reviewed the whole subject of the serum diagnosis of tuberculosis as employed by Arloing and Courmont. Our tests were made absolutely according to the directions given us by Dr. Paul Courmont in person. We found that the serum of healthy individuals agglutinated tubercle bacilli almost as frequently as did the serum of patients suffering from pulmonary tuberculosis (84.28 per cent. for healthy, and 87.09 per cent. for tuberculous persons), and that the agglutinating value in these healthy and tuberculous subjects was practically the same (13.67 for healthy, and 14.82 for tuberculous). We, therefore, agreed with Koch, Beck and Rabinowitsch, C. Fränkel, Romberg, and others, that the serum diagnosis of tuberculosis is of no value in the diagnosis of pulmonary tuberculosis. We next turned our attention to the effect of tuberculin treatment on the serum agglutination.

During his investigations into the relation of cattle to human tuberculosis, Koch felt compelled to apply the agglutination test as a means of differentiating the two bacteria, and first attempted to follow the method of Arloing and Courmont. He found, however, that their method was too complicated for practical use, and

[1] Amer. Jour. Med. Sci., October, 1906.

that it did not give uniform and reliable results. He therefore prepared an emulsion of pulverized tubercle bacilli.[2] When a test is made with Koch's test mixture, diluted to 1 to 10,000, it is found that the greater part of the reaction has occurred at the end of fifteen to twenty hours. In our tests we gave a limit of twenty-four hours. The length of time of the reaction, the temperature at which the tests are made, and the amount of mixture must always be exactly the same.

With this emulsion tests may be made either in the morning or afternoon. They are placed in the incubator at 37° C. over night, and then examined the following day. Serums should be used clear, and should be as fresh as possible. In all our tests serums from fifteen to twenty-four hours old were used. It is necessary that an absolutely certain macroscopic appearance be accepted as the limit of agglutination, if one desires to obtain comparable data. At the limit of agglutination there should still be present macroscopically a loose, clearly distinguishable, and evenly distributed precipitate.

In his experiments on animals, Koch found that in order to give rise to the agglutinating power, and when it is already present, to increase it, it was necessary to have marked, and if possible, strong reactions from tuberculin. Agglutination usually first shows itself several days after the injection. It reaches the highest grade in from seven to ten days and then slowly sinks. It is, therefore, necessary to make the agglutination tests in from seven to ten days after the injections, in order to obtain the highest degree.

When animals are treated with cultures of bacteria with a view to immunization, there regularly appear in their blood in addition to the agglutinating, also immunizing properties, presumably of bactericidal nature. Koch, therefore, took it for granted that in his animals, if they were brought artificially to a more or less high agglutinating power, there was produced a certain degree of immunity. He leans to the view that the agglutinating power is to be classed with the immunizing properties, and considers that the degree of agglutinating power and the immunity stand to one another in a certain relation, at least at the beginning of the immunizing process, and that the agglutinating power is a standard for the grade of immunity produced.

There is produced from tuberculosis under natural conditions no, or very little, resisting substance in order to permit it to come to cure and resulting immunity. The question forced itself upon Koch, namely, after it is possible, with comparative ease, to raise in animals the agglutination and amount of resisting substances so extraordinarily, whether it is not possible, by means of artificial production of resisting substances, to assist the human organism in

[2] Deut. med. Woch., 1902, Nr. 88.

its struggle against tuberculous disease. He believed that he solved this matter in a satisfactory may by the agglutinating method, since he considered that this method informed him whether he was on the right path with his immunizing experiments.

First of all he ascertained on animals, in what form, dose, and method of application tubercle bacilli cultures must be employed in order to produce agglutinating values as soon and as high as possible. He then cautiously transferred to man the experiences thus obtained.

It turned out that pretty high agglutinating values exist if the entire substance of the tubercle bacillus is injected subcutaneously. The bacilli, however, must be worked up to a fine powder in order to be absorbed.

In his earlier immunizing experiments, Koch divided the powdered tubercle bacilli by centrifugation into two parts: into the undissolved residue (T.R.) and the supernatant fluid (T.O.). The T.R. again rubbed up and sedimented gave relatively weak, the T. O. strong reactions. In order to avoid reactions as much as possible, he gave T.R. the preference. By the help of the agglutination test he found that it is better to use the culture mass unseparated, and that the agglutinating power in man occurs surest and quickest when not too slight reactions occur, and when high doses are reached as quickly as possible. This is Koch's latest tuberculin, and is called Bacillen-emulsion.[3]

As a rule his first subcutaneous injection of this preparation was 0.0025 milligram. (This is always estimated as bacillus substance). He then increased the doses very quickly, with pauses of from one to two days, each time about from two to fivefold, until he came to very pronounced reactions with temperature elevations of from 1.5 to 2° C. (that is, 2.7° to 3.6° F.). When a strong reaction of this kind occurred he advised that much longer pauses should be made. As a rule he waited for six to eight days and longer, indeed, after the result of the agglutination test. Every patient was tested for the presence of agglutinating power before beginning treatment, and again just after the first two or three reactions. When the agglutinating power appeared positive, or if already present, it was increased by the injection, this degree of agglutination was maintained, and, when possible, pushed still higher. Koch, therefore,

[3] Koch makes his tubercle vaccine, which he calls Bacillen-emulsion, in the following way: He takes 1 part pulverized tubercle bacilli with 100 parts distilled water to which equal parts of glycerin are added. To make a good emulsion take a large agate mortar, and slowly add the glycerin and water to the tubercle powder so as to have a thorough mixture. This mixture remains standing several days. It is then poured off from the coarse particles no longer in suspension, and so kept. 1 c.c. of the preparation corresponds to 5 milligrams of pulverized tubercle bacilli. (N. B.—This is really not so, because, when the emulsion stands for several days, so that the coarse particles may sediment, a considerable amount of bacillus substance is lost, and each cubic centimeter of the Bacillen-emulsion may then contain only 2 or 3 milligrams of bacillus substance. It may then, however, be standardized to contain 5 milligrams to each cubic centimeter.)

never reduced the dose and did not repeat the same dose, but always increased it. Otherwise the agglutinating power soon sank, and the advantage obtained was again lost. With subcutaneous injections he increased to doses of 20 milligrams, in individual cases even to 30 milligrams. The larger doses of 10 to 20 milligrams were given by him only in pauses of from two to four weeks.

Occasionally the agglutinating power sank in spite of the continuously increased dose. In such cases he regularly succeeded by intravenous injections of the preparation in increasing the agglutinating power in a surprising way. For this he employed only a liquid obtained by powerful and long centrifugation, and from which all suspended ingredients were carefully separated. He then treated his patients by beginning with subcutaneous injections, and continued with intravenous injections as soon as reactions appeared. Reports of seventy-four patients treated in this manner were, on the whole, favorable, but further reference to these or similarly treated cases have not appeared since to our knowledge.

Employment of the Agglutinating Tests at the Saranac Laboratory. In our endeavors to test the value of the agglutinating methods on man as a means of control while giving our tuberculin doses, and to compare our results with those of Koch, we were at once confronted by a grave difficulty. Dr. E. R. Baldwin found that the large laboratory animals were occasionally made dangerously sick by repeated intravenous injections of tuberculin, especially emulsions, and that several of them died soon after the injections when they were given in this way. We, therefore, considered that the intravenous method of giving tuberculin injections was accompanied by great danger and that it should not be employed on man. As a result, all our tuberculin injections on man were made subcutaneously. Another difficulty in the way of comparing our results with Koch's was that he sought to produce reactions as soon and as pronounced as possible, and to reach high doses as quickly as possible. We sought to avoid them altogether, if possible, and we frequently carried our patients to large doses of tuberculin—to 1 gram of old tuberculin, or 2 milligrams Bacillen-emulsion, with either no or few reactions. The period of time over which treatment continued was also very different; with Koch it lasted six months or longer, while with us it frequently lasted eighteen months or longer. Our investigation was thus not a test of Koch's method of giving Bacillen-emulsion as controlled by the agglutination test, but to see if the agglutination test was of value to control tuberculin injections, when these injections were given subcutaneously, and according to the slow or progressive method. The agglutination tests were made not only with Koch's agglutinating emulsion, but also simultaneously according to Arloing and Courmont's method, and with their "A" homogeneous bacillus. Comparative results of theese two methods were thus obtained. The

plan of the investigation was to test the agglutination before tuberculin treatment was begun, and then from time to time through the course, and finally at the end of treatment. Tests were made at varying intervals after the dose, but usually in from seven to twelve days.

The character of the cases given tuberculin treatment differed from Koch's. A few were incipients, but most of them were advanced cases without fever and in good physical condition. With Koch many of the cases were advanced with fever.

Of the 15 cases treated by tuberculin, the following agglutinating power was obtained at some time during the course of treatment.

Koch's method.		Arloing and Courmont's method.	
1 to 10	0 patients.	1 to 10	1 patient.
1 to 15	0 "	1 to 15	1 "
1 to 25	2 "	1 to 25	5 "
1 to 33	2 "	1 to 33	4 "
1 to 50	4 "	1 to 50	1 "
1 to 75	3 "	1 to 75	0 "
1 to 100	1 "	1 to 100	1 "
1 to 125	0 "	1 to 125	1 "
1 to 150	1 "	1 to 150	0 "
2 cases not tested.		1 case not tested.	

Of 42 simultaneous tests by the two methods the results were the same in 8, and differed in 34. Of these 34 tests Koch's method had a higher agglutinating value in 19, and a lower in 15. The maximum degree of agglutination obtained at some time during the course of treatment was higher in 8 cases with Koch's method; was the same with both methods in 4 cases; and was higher with the French method in 1 case. Comparative results on this point were not obtained in the other 2 cases.

With Koch's method the observation of facts was very difficult, and it was sometimes impossible to determine the exact degree of agglutination. With the French method agglutination occurs in large flocculi, and the degree of agglutination can be seen even by an untrained eye.

In examining these 15 cases it is seen that the degree of agglutination increased in all except in one case. This occurred with both methods. It is interesting to note that with Koch's method, in the majority of cases, the maximum degree of agglutination did not occur at the end of treatment as one would expect, but at some time during the course of treatment. With the French method the agglutination was at its highest point at the end of treatment in 12 out of 14 fully tested cases. In spite of the fact, however, that the degree of agglutination would sometimes fall from its maximum point as the tuberculin treatment proceeded, we increased the doses in the usual way and did not observe that this fall in agglutination was accompanied by any deterioration in the health of the patient.

The important question to determine from this investigation is

whether the agglutination test, either by Koch's method or by that of Arloing and Courmont, is of any value as a control in giving tuberculin treatment as administered hypodermically according to the slowly progressive method. From an experience of over three years with these methods, we have not found them to be of any value. Neither method is sufficiently delicate to show slight variations in agglutination, and it was a common experience to see the agglutinating value fall, even when the patients were steadily improving.

Effect of the Tuberculin Treatment on the Patients. Of the above 15 cases, 2 became clinically healed during a previous course of tuberculin, and were undergoing a second immunizing course. Two others received two courses of tuberculin treatment, but their condition at the end of the first course is now considered. We have, therefore, 11 cases to report upon. Of these 11 cases 2 were incipient and 9 were advanced. The 2 incipient cases became apparently cured; 1 of the advanced cases became apparently cured; and the 8 remaining advanced cases came to an arrested condition. Within a year 2 others of these advanced cases became apparently cured. In describing the results in these cases we use the terms according to the definitions employed by the National Association. Our aim throughout was to produce as few and as slight reactions as possible. Two patients reached 1 gram of old tuberculin with no, or a doubtful, reaction, 1 patient reached 0.51 gram of old tuberculin, 1 patient reached 0.68 gram of old tuberculin, and 1 patient reached 0.1 gram of old tuberculin with no reactions. In the remaining cases the number of reactions varied from 1 to 3. No harm was ever seen to follow fever reactions, and, although we tried to avoid them, yet we never felt any anxiety when they occurred. A notable feature throughout was the absence of hemorrhage in all the cases. Several of the patients had had hemorrhages previous to beginning tuberculin treatment, but practically no further blood-spitting occurred. We mention this fact as Meissen, of Hohenhoneff, thinks that tuberculin injections tend to produce hemorrhages. Our experience has been directly contrary to this, as those patients who have taken tuberculin treatment have been singularly free of hemorrhages.

Subsequent History of the Tuberculin-treated Cases. The 2 incipient cases have remained cured. Of the 9 advanced cases the one which was apparently cured at the end of treatment has since shown tubercle bacilli in her sputum. In the winter of 1907–1908 she developed a severe grip accompanied by bronchitis, and tubercle bacilli are now present in her sputum. In other respects she is in good condition, but is now classed as an arrested case. Of the remaining 8 cases which were classed as arrested at the end of treatment, 2 have since become apparently cured, 4 have kept on steadily improving, 1 has relapsed, and 1 died. We wish to express our strong conviction of the value of the tuberculin treatment on these cases as a whole.

		Remarks.	Koch's method.	Arloing and Courmont's method.
Case I. F. D. A.	Advanced (afebrile). No tubercle bacilli in sputum.	Test made February 20, 1905, 9 days after 0.1 grm. old tuberculin. Test made June 2, 1905, 31 days after 0.57 grm. old tuberculin. At the end of treatment this case had no cough, no expectoration, and no tubercle bacilli, and the physical signs showed a healed lesion. He was classed as apparently cured. He had 2 reactions, the first at 0.0003 grm. and the second at 0.00029 grm., and then went to 0.57 grm. without reacting. The duration of treatment was 12 months.	Not tested No agglutination	Agglutinated at 1 to 10 Not tested
Case II. F. D. A.	Cured case.	Test made November 18, 1905, before beginning treatment. Test made June 11, 1906, 8 days after 1.17 mgrm. Bacillen-emulsion. Test made July 10, 1906, 9 days after 1.47 mgrm. Bacillen-emulsion. Test made July 24, 1906, 7 days after 1.61 mgrm. Bacillen-emulsion. This was an apparently cured case that was taking a second course of tuberculin treatment. He reached 1.69 mgrm. Bacillen-emulsion in 7 months without a reaction.	No test made + 1 to 50 + 1 to 10 + 1 to 15; ± 25 to 33	+ 15 + 15; ± 25 + 15 + 15; ± 25
Case III. W. F.	Advanced (afebrile). Tubercle bacilli in sputum.	Test made before beginning old tuberculin treatment. Test made November 26, 1904, 4 days after 0.026 grm. old tuberculin. Test made January 11, 1905, 5 days after 0.055 grm. old tuberculin. Test made February 7, 1905, 10 days after 0.1 grm. old tuberculin. Test made March 27, 1905, 7 days after 0.1 grm. old tuberculin. Test made April 12, 1905, 11 days after 0.11 grm. old tuberculin. The maximum dose was 0.14 grm. At the end of this treatment this patient was a well-arrested case, tubercle bacilli were still in the sputum and he had cough, but the physical signs had much improved, as also had his general condition. He reached 0.140 grm. old tuberculin without reacting, but a little later had a slight reaction at 0.110 grm. Duration of treatment, 11 months.	No agglutination + 1 to 25; ± 1 to 50 No agglutination No agglutination No test made. + 1 to 5	Not tested + 1 to 25; ± 1 to 50 + 1 to 10 + 1 to 10 + 1 to 10 + 1 to 50
Case IV. W. F.	Advanced (arrested). Tubercle bacilli in sputum.	Test made June 29, 1905, before beginning Bacillen-emulsion. Test made November 2, 1905, 8 days after 0.68 mgrm. Bacillen-emulsion. Test made February 3, 1906, 18 days after 0.7 grm. bacillen-emulsion. This was an arrested case undergoing a second course of tuberculin treatment. He reacted twice at 0.68 mgrm. Bacillen-emulsion. The maximum dose was 0.7 mgrm. Bacillen-emulsion. Duration of treatment, 6½ months.	+ 1 to 25 + 1 to 15; ± 1 to 25 + 1 to 25	No test + 1 to 15 + 1 to 15; ± 1 to 25
Case V. J. H.	Advanced (afebrile). Tubercle bacilli in sputum.	Test made before beginning old tuberculin treatment. Test made October 26, 1905, 4 days after 0.00075 grm. old tuberculin. Test made May 21, 1906, 10 days after 0.16 grm. old tuberculin. At the end of treatment this patient had no cough, but still had very slight expectoration which contained a very few tubercle bacilli. The physical signs had markedly improved. Five months later there was no cough, very slight expectoration, which did not contain tubercle bacilli. The physical signs showed a healed condition. She had four reactions, the first at 0.025 grm. old tuberculin, the second at 0.023 grm., the third at 0.029 grm. and the fourth at 0.16 grm. Duration of treatment, 22¼ months.	+ 1 to 5; ± 1 to 10 + 1 to 5 + 1 to 33	+ 1 to 5 No test made + 1 to 33

Case VI. A. C. H.	Incipient (afebrile). Tubercle bacilli in sputum.	Test made October 5, 1905, before beginning old tuberculin treatment.	+ 1 to 25	+ 1 to 10; ± 1 to 15
		Test made February 2, 1907, 8 days after 0.17 grm. old tuberculin.	+ 1 to 25	+ 1 to 25
		Test made May 30, 1907, 9 days after 0.455 grm. old tuberculin.	+ 1 to 50	+ 1 to 33
		At end of treatment this patient was apparently cured, and had no cough, no expectoration, and no tubercle bacilli. He had one reaction at 0.00013 grm. old tuberculin, and then went to 0.455 grm. without a reaction. Duration of treatment was 18½ months.		
Case VII. E. G.	Advanced (afebrile). Tubercle bacilli in sputum.	Test made February 20, 1905.	No test made	+ 1 to 25
		Test made November 2, 1907, before beginning old tuberculin treatment.	+ 1 to 15; ± 1 to 25	+ 1 to 25; ± 1 to 33
		Test made February 2, 1907, 10 days after 0.188 grm. old tuberculin.	+ 1 to 50	+ 1 to 33
		Test made May 27, 1907, 10 days after 0.51 grm. old tuberculin.	+ 1 to 25	+ 1 to 33
		At end of treatment this patient was a well-arrested case; tubercle bacilli were still in sputum, but her general condition and the physical signs were much improved. No reactions. Duration of treatment, 18 months. Maximum dose, 0.51 grm. old tuberculin.		
Case VIII. H. L.	Advanced (afebrile). Tubercle bacilli in sputum.	Test made January 14, 1905, at onset of treatment of old tuberculin.	No agglutination	+ 1 to 15
		Test made April 17, 1905, 2 days after 0.0015 grm. old tuberculin.	+ 1 to 5	+ 1 to 15
		Test made July 10, 1905, 8 days after 0.01 grm. old tuberculin.	+ 1 to 10; ± 1 to 15	No test made
		Test made January 19, 1906, 12 days after 0.53 grm. old tuberculin.	+ 1 to 75	+ 1 to 25
		Test made March 16, 1906, 12 days after 0.68 grm. old tuberculin.	+ 1 to 25	+ 1 to 25; ± 1 to 33
		At end of treatment this patient was a well-arrested case, had no cough, but still slight expectoration and a few bacilli; his general condition and physical signs had much improved. No reactions. Duration of treatment, 14 months. Maximum dose, 0.68 grm. old tuberculin. A year and one-half later the tubercle bacilli had disappeared from his sputum and he was at work, and was apparently cured.		
Case IX. D. C. M.	Advanced (afebrile). Tubercle bacilli in sputum.	Test made December 16, 1904, at onset of old tuberculin treatment.	No agglutination	+ 1 to 10
		Test made April 17, 1905, 2 days after 0.005 grm. old tuberculin.	No agglutination	+ 1 to 5; ± 1 to 10
		Test made December 1, 1905, 8 days after 0.1 grm. old tuberculin.	+ 1 to 75	+ 1 to 10
		At end of treatment the patient was in a well-arrested condition; he had a slight cough, and slight expectoration, and a few tubercle bacilli; the physical signs and his general condition had improved. No reactions. Duration of treatment, 10 months. Maximum dose, 0.114 grm. old tuberculin.		
Case X. J. P.	Advanced (afebrile). Tubercle bacilli in sputum.	Test made December 21, 1904, at onset of old tuberculin treatment.	No test made	+ 1 to 5
		Test made July 3, 1905, 8 days after 0.01 grm. old tuberculin.	+ 1 to 10; ± 1 to 15	No test made
		Test made January 19, 1906, 12 days after 0.53 grm. old tuberculin.	+ 1 to 75	+ 1 to 15; ± 1 to 25
		Test made April 7, 1906, 11 days after 1 grm. old tuberculin.	+ 1 to 15	+ 1 to 10
		At end of treatment this patient was apparently cured; had no cough, no expectoration and no bacilli; the chest showed a healed lesion.		
		Test made July 25, 1906, 3 months after 1 grm. old tuberculin.	+ 1 to 10	+ 1 to 25
		No reactions. Duration of treatment, 15 months. Maximum dose, 1 grm. old tuberculin.		

	Remarks.		Koch's method.	Arloing and Courmont's method.
Case XI. J. P.	Advanced (afebrile). Tubercle bacilli in sputum.	Test made October 4, 1905, before beginning old tuberculin treatment. Test made December 13, 1906, 8 days after 0.3 grm. old tuberculin. Test made March 30, 1907, 9 days after 0.55 grm. old tuberculin. Test made May 4, 1907, 7 days after 0.5 grm. old tuberculin. At end of treatment this patient became well-arrested. He had no cough, only slight expectoration, which contained a few tubercle bacilli. The physical signs and general condition were much improved. He had two reactions: one at 0.38 grm., and one at 0.55 grm. Duration of treatment, 18½ months. Maximum dose, 0.55 grm.	+ 1 to 15 + 1 to 15; ± 1 to 25 + 1 to 10; ± 1 to 15 + 1 to 15; ± 1 to 25	+ 1 to 5 + 1 to 15; ± 1 to 25 + 1 to 10; ± 1 to 15 + 1 to 15
Case XII. A. P.	Midway between advanced and far advanced (afebrile). Tubercle bacilli in sputum. Had also laryngeal tuberculosis.	Test made January 28, 1905, before onset of old tuberculin treatment. Test made July 1, 1905, 8 days after 0.05 grm. old tuberculin. Test made October 16, 1905, 8 days after 0.38 grm. old tuberculin. Test made December 20, 1905, 13 days after 0.63 grm. old tuberculin. Test made February 22, 1906, 9 days after 1 grm. old tuberculin. At end of treatment this patient became well-arrested; there was still cough and expectoration and tubercle bacilli in sputum, but the physical signs and general condition had much improved. No reactions. Maximum dose, 1 grm. old tuberculin. Duration of treatment, 12½ months. There was still a tuberculous mass in the larynx, but no ulceration.	+ 1 to 5 + 1 to 33; ± 1 to 50 + 1 to 33; ± 1 to 50 + 1 to 75; ± 1 to 100 + 1 to 150	+ 1 to 5 No test made + 1 to 10 + 1 to 10 + 1 to 15; ± 1 to 25
Case XIII. L. M. N.	Midway between advanced and far advanced (afebrile). Tubercle bacilli in sputum.	Test made July 5, 1905, at onset of old tuberculin treatment. Test made October 26, 1905, 3 days after 0.00068 grm. old tuberculin. Test made February 2, 1907, 8 days after 0.117 grm. old tuberculin. Test made May 30, 1907, 9 days after 0.3 grm. old tuberculin. At end of treatment this patient became a well-arrested case; there was still cough and expectoration, and tubercle bacilli in sputum; the physical signs and the general conditon had improved. One reaction at 0.039 grm. old tuberculin. Maximum dose, 0.3 grm. Duration of treatment, 23 months.	+ 1 to 50 + 1 to 75; ± 1 to 100 + 1 to 50 + 1 to 25	Varied from + 75 to 125 + 1 to 75 + 1 to 75 + 1 to 125
Case XIV. G. R.	Apparently cured (afebrile). No tubercle bacilli in sputum.	Test made November 29, 1904, before beginning Bacillen-emulsion. Test made April 4, 1905, 6 days after 1.02 mgrm. Bacillen-emulsion. This patient was an apparently cured case that took a second course of tuberculin treatment.	No agglutination No test made	No agglutination + 1 to 75; ± 1 to 100
Case XV. G. R.	Apparently cured (afebrile). No tubercle bacilli in sputum.	Test made November 15, 1905, before beginning Bacillen-emulsion. Test made May 4, 1907, 10 days after 1.45 mgm. Bacillen-emulsion. This was an apparently cured case that took a further course of tuberculin treatment.	+ 1 to 50 + 1 to 15; ± 1 to 33	+ 1 to 5; ± 1 to 10 + 1 to 15

SUMMARY.

Case.	Amount of agglutination at onset of treatment.		Maximum agglutination.		Amount of agglutination at end of treatment.		Remarks.
	Koch.	Arloing and Courmont.	Koch.	Arloing and Courmont.	Koch.	Arloing and Courmont.	
I	Not tested	1 to 10	....	....	No agglutination	Not tested	Maximum dose, 0.57 grm. old tuberculin
II	Not tested	1 to 15	1 to 50	1 to 25	1 to 33	1 to 25	Maximum dose, 1.61 mgrm. Bacillen-emulsion
III	No agglutination	Not tested	1 to 50	1 to 50	1 to 5	1 to 50	Maximum dose, 0.14 grm. old tuberculin
IV	1 to 15	Not tested	1 to 25	1 to 25	1 to 25	1 to 25	Maximum dose, 0.7 mgrm. Bacillen-emulsion
V	1 to 10	1 to 5	1 to 33	1 to 33	1 to 33	1 to 33	Maximum dose; 0.16 grm. old tuberculin
VI	1 to 25	1 to 15	1 to 50	1 to 33	1 to 50	1 to 33	Maximum dose, 0.455 grm. old tuberculin
VII	Not tested	1 to 25	1 to 50	1 to 33	1 to 25	1 to 33	Maximum dose, 0.51 grm. old tuberculin
VIII	No agglutination	1 to 5	1 to 75	1 to 33	1 to 25	1 to 33	Maximum dose, 0.68 grm. old tuberculin
IX	No agglutination	1 to 10	1 to 75	1 to 10	1 to 75	1 to 10	Maximum dose, 0.1 grm. old tuberculin
X	Not tested	1 to 5	1 to 75	1 to 25	1 to 15	1 to 10	Maximum dose, 1 grm. old tuberculin
XI	1 to 15	1 to 5	1 to 25	1 to 25	1 to 25	1 to 15	Maximum dose, 0.55 grm. old tuberculin
XII	1 to 5	1 to 5	1 to 50	1 to 25	1 to 150	1 to 25	Maximum dose, 1 grm. old tuberculin
XIII	1 to 50	1 to 125	1 to 100	1 to 125	1 to 25	1 to 125	Maximum dose, 0.3 grm. old tuberculin
XIV	No agglutination	No agglutination	Not tested	1 to 100	Not tested	1 to 100	Maximum dose, 1.02 mgrm. Bacillen-emulsion
XV	1 to 50	1 to 10	1 to 50	1 to 15	1 to 33	1 to 15	Maximum dose, 1.45 mgrm. Bacillen-emulsion

In conclusion, we wish again to state that in our hands the agglutination test has not proved itself of value to control tuberculin administration when given to cases with pulmonary tuberculosis. We consider that the only reliable means which we have at present to govern such cases is to observe them carefully after each dose of tuberculin, and to be acquainted with even the slightest signs of reaction; in other words, that the clinical method is at present the most reliable method to govern us when giving tuberculin treatment to cases of pulmonary tuberculosis. We have had no experience in the use of the agglutination or opsonic method in surgical tuberculosis, although the latter appears of value according to some workers, referring to Wright's school.

THE VALUE OF RÖNTGEN-RAY EXAMINATION IN THE DIAGNOSIS OF PULMONARY TUBERCULOSIS, ESPECIALLY IN REFERENCE TO EARLY TUBERCULOSIS.[1]

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Almost all recognized radiologists have expressed themselves concerning the value of Röntgen-ray examinations in the recognition of early pulmonary tuberculosis. In addition to Professor Rieder, I may name Albers-Schönberg, A. Köhler, Holzknecht, Immelmann, Levy-Dorn, Bade, Hildebrandt, Gocht, Schellenberg, and Grunmach; in America, Williams and Walsham; and in France, Beclere. Even today opinions as to the value of the method are by no means clear. Advance, of late, however, is to be noted, inasmuch as the enthusiasts, whom we heard in the early days of the Röntgen era, have been silenced, and among the fewer well-informed the belief has been awakened that it is only necessary to take the fluoroscopic screen in hand to detect at the apex of the lung the smallest tuberculous change. Today the majority of physicians are opposed to *x*-ray examinations in early tuberculosis, but according to my belief unjustly so. This comes in largest part because, from the first, more has been expected of *x*-ray diagnosis, than a priori is possible for it to give. It cannot and never can lead to an absolutely certain diagnosis, when even with all clinical and bacteriological methods of examination such diagnosis is impossible. I believe, further, that this never will be possible, notwithstanding all anticipated improvements in the technique. Anything different is not to be expected. How often it is our experience

[1] Read at the International Congress on Tuberculosis, Washington, D. C., September-October, 1908.

that other methods, for example, the chemical, bacteriological, and even the anatomical, are not in a position to give a clear interpretation of pathological relations. Even with these methods frequently the conclusion is *non liquet*.

I purpose here not to review critically the opinions of all observers as I glean them from their contributions and, in part, from their expressions of opinion, but to state, with due regard to the results of the investigations of other authors, my own observations as to the manner and extent in which the *x*-rays have served me in the diagnosis of early tuberculosis. These conclusions are based on my extended experience in the medical clinic at Breslau and in the medical polyclinic at Jena.

I. First a few words about the technique of *x*-ray examinations in pulmonary disease: Among a large clientele, especially if it is composed of ambulatory patients, the fluoroscope is preferable. *X*-ray photography costs too much in time and money, and is, on that account, to be reserved exclusively for special cases. If the fluoroscopic screen is to be employed in a correct, profitable way, the following points must be considered:

1. The examining room must be darkened in the most complete way possible. An examination in a room in which, from unexcluded daylight, all objects may be recognized is thoroughly inadequate, and to my mind impossible. In spite of this, I saw within the last year, in an *x*-ray laboratory, that this factor important to a successful examination was not entirely fulfilled.

2. The *x*-ray tube must be placed in an absolutely light-tight box so that the fluorescent light of the *x*-rays is completely masked. The usual method formerly employed of excluding the rays by means of a dark cloth proved entirely inadequate. Covering the *x*-rays with a pasteboard box or a screen is likewise insufficient. If delicate distinctions are to be detected in the fluorescent light of the Röntgen screen, it is absolutely requisite that no other disturbing light phenomena shall encroach. The room must always remain absolutely dark during the use of delicate tubes.

3. The fluoroscopic box must be provided with a lead covering to protect the patient and the operator against the baneful influence of the *x*-rays.

4. The box must be so hung as to be easily movable, in order that the tube may be manipulated without difficulty.

5. The arrangement of diaphragms must be as good as possible. My experience is that the slit diaphragm is to be preferred to the round diaphragm for fluoroscopic examinations of the apices.

It is obvious that to obtain satisfactory results a good, luminous barium-platinum-cyanide screen is necessary. Likewise the eye of the operator must be rested, so as to be completely adapted to darkness. In this last respect all of us have frequently failed, when amidst the rush of a large clinic or dispensary there was not

time enough to wait for this. When the result of an examination is doubtful, the time must be found. Upon coming from daylight, which is bright or even dull, at least three to five minutes should be spent in the dark room, in order to rest the retina before proceeding with the examination. Through this slight delay the ability to detect delicate differences on the screen will be materially increased.

If the Röntgen photograph is to be employed, it is well to use for this purpose the diaphragm plates of Albers-Schönberg, if possible, in the dorsoventral and ventrodorsal diameters. Recently I used with advantage the examining chair devised by Albers-Schönberg for this work. First of all, with the slit diaphragm, the apices of the lungs are brought into the best possible focus with the patient in a sitting position. Following fixation the plate is inserted and an exposure of fifteen to twenty seconds is made with the full strength of the tube. The round diaphragm also gave good results.

II. Since in early adult pulmonary tuberculosis we expect differences in the transparency of the apices, it is both desirable and valuable to learn whether in persons, in whom beyond question there is no difference to be found at the apices by means of percussion and ascultation, there exist differences in regard to the transparency and expansion of the apices of the lungs. In order to answer this question I have looked over 80 previously collected cases of my own, in addition to about 180 suitable cases from our wealth of clinical material (we had 5880 patients in the Medical Polyclinic at Jena during the past year) which, along with Dr. Friedrich, I have examined with especial reference to this. In this conjunction I will briefly mention that undoubtedly conditions exist which make the normal lung apex appear dark with the fluoroscope. Among these conditions are the following: (1) Changes in the skin (scleroderma and edema of the skin). (2) Marked increase of the subcutaneous fat (general obesity, lipoma formation). (3) Enlarged, caseous, indurated, calcified lymph glands, which lie in the supraclavicular fossa or in the superficial or deep cervical region. (4) Remarkably good musculature. This is more marked especially on the right side than on the left; on this account noticeable röntgenoscopic differences occur. (5) Aside from the four above noted points, now and again darkening of the apices is seen because of the blending of the shadows of the clavicle and first ribs, or because the apices are unusually deeply placed. If these observations are taken into consideration, in order to avoid errors, one should carefully inspect and palpate before giving an opinion as to the results of *x*-ray findings, or even before making an examination; usually also before the fluoroscopic examination.

From my own experience there also occur in doubtful pulmonary cases, in which the above sources of error have been excluded, slight variations in the transparency of the lung apices. They are,

indeed, only slight, but in the future will cause me to control regularly the fluoroscopic examinations of doubtful cases by means of the *x*-ray picture. As regards the expansion and height of the apices, in unproved pulmonary cases slight differences are also noted by the *x*-ray examination. In a series of observations carried out under the direction of Professor Gerhardt at the Medical Polyclinic in Jena, Dr. Seufferheld obtained from examination of the apices by physical examination results that were to be expected, that is, slight differences in the percussion note and variations in the breath sounds. Further, Kronings, in some interesting examinations, discovered that there exists congenital, but little understood, malformations of the apices (heteromorphia and heterotopia). These also can cause röntgenoscopic variations.

III. What can we accomplish, with attention to the enumerated points, by means of *x*-ray examinations in early tuberculosis?

A. Early Tuberculosis in the Adult. In adults we look for and find, with ordinary clinical methods of examination, for the most part, a lesion at the apex; in early cases frequently only a catarrh, in further advanced cases infiltration processes. In a large number of these there are only uncertain findings—differences of pitch, uncertain roughened breathing, and prolonged expiration. If infiltrations are present, the air-containing tissue is replaced by airless or rather air-poor tissue. In such cases we see, provided the infiltration has progressed sufficiently, instead of transparency, a deep or moderately deep shadow, according to the extent of the lesion. If the infiltration extends to or into the neighborhood of the surface of the apex, we may recognize it by percussion, auscultation, and röntgenography. If it exists in the centre of the apex, without approaching the surface, or if isolated, unusually large confluent emphysematous bubbles have formed above the infiltration process (as I found explained by autopsy in a particular case), the infiltration is not recognizable by percussion. On the other hand, such lesions are seen excellently with the fluoroscope and *x*-ray pictures. I dispose of those examination findings which confirm or supplement our clinical findings in an unexpected way. In addition, in many cases in which we have positive dulness and in which a decided shadow is to be expected, our clinical findings are proved, inasmuch as the extent of the infiltration is shown to be greater than was expected.

I have convinced myself, by the method of Albers-Schönberg, that infiltrations exist, which, even with good diaphragming, can either not be recognized or only very uncertainly recognized by means of the fluoroscope. On the other hand, they give absolutely certain findings on the plate, especially with diaphragm pictures.

Thereto in part belong those cases in which we have uncertain percussion findings, merely slight catarrh, or only doubtful percussion and respiratory signs. Under these conditions, we obtain

differences in the fluoroscopic picture of the apices, just as we did in unrecognizable pulmonary disease. In such patients the photograph asserts its importance and is indispensable.

In patients who give apical findings suspicious of tuberculosis, without having frank auscultatory or percussion signs, we repeatedly see well-marked darkened apices, which do not clear up upon repeated deep inspirations. Besides, in these patients the photographic plate repeatedly shows not only a reduced air-content, recognizable by a cloud-like shadow, but also a circumscribed shadow, seen over deep-seated infiltrations. When both apices are equally or only slightly darkened, I have grown cautious with the röntgenoscopic diagnosis, because I have often found that by means of systematic weekly or bi-weekly breathing exercises the apices have cleared up very considerably.

In regard to the height of the apices, no significance can be attached to slight differences. If there exists a difference of 1 to 2 cm., especially if associated with alterations in the transparency, the presence of contraction may be inferred. I have also taken up röntgenographically the width of the apices, in sagittal section. Krönig has taught widely throughout medical circles the importance of determining this by means of percussion. Some time ago Freund again pointed out the importance of ossification of the first costal cartilage in the beginning of pulmonary tuberculosis. This led to proof of the early ossification of the costal cartilages by means of the *x*-rays. Immelmann and F. M. Grödel have paid especial attention to this and have reported suggestive results. It is, however, advisable that further studies be undertaken along this line.

A certain importance seems to have been attached to a symptom described some years since by Williams, that is, the lagging of the movements of the diaphragm on the affected side, even in the early stage of incipient tuberculosis. Statements to the contrary notwithstanding, I personally cannot attach any diagnostic importance to this symptom. I have failed to find it in somewhat over half the cases. With the object in view of proving this, I intend to make measurements of the extent of the excursion of the diaphragm movements. It seems to me that at present, Williams' phenomenon cannot find application as an aid to the early diagnosis of tuberculosis of the lungs.

If we ask the question, whether the signs elicited by the *x*-rays permit of a positive diagnosis, or whether the changes that are observed can be interpreted as especially tuberculous, or whether they can also occur in diseases of other genesis, as from the inhalation of dust or anthracosis, we can only give a provisional answer. To my mind these processes have nothing specific about them; we cannot see with the *x*-rays tuberculous processes in the strict sense; we see only the condensation of tissue caused by the tubercle bacilli. The fact is, that we need clinical methods in order to determine the

diagnosis of tuberculosis; the *x*-ray findings do not suffice. Furthermore, whether the change which exists is active or passive cannot be determined. Therefore, I practise fluoroscopy as a method which is to be regarded somewhat the same as bacteriological methods are regarded in relation to percussion and auscultation; but like them it is not enough alone to determine the clinical diagnosis of tuberculosis.

B. Early Tuberculosis in Children and Young People. In many cases we find the apices of the lungs free from disease. Above all, we further know, through the anatomical findings, that pulmonary tuberculosis of children and young people begins in the glands at the hilum of the lungs. Frequently clinical examinations fail or give ambiguous results. By means of the fluoroscope (good diaphragming is always essential) or the *x*-ray photograph, changes in the hilum shadows can be shown positively (that is, shadows of enlarged calcified glands) which are not revealed by any other method.

I now desire to call attention to a type of early pulmonary tuberculosis which occurs in youth. We frequently see a disease characterized by all the symptoms of a central pneumonia—high fever, rapid pulse, rusty sputum, and pneumococcic bacteremia. Through the aid of the fluoroscope we can demonstrate a more or less extensive, deep shadow. After a number of days, about five to nine the fever disappears, but by the fluoroscope and photographs it can be noticed that the shadow has not become more transparent. In fact, in the course of the succeeding week, extension occurs, frequently first seen as string-like shadows tending toward the periphery. In my cases the subsequent gradual recurrence of fever and finally the presence of tubercle bacilli in the sputum proved that, as a matter of fact, the condition was tuberculous. This clinical course seems not uncommon in younger people.

For the recognition of tuberculosis of the bronchial glands examination by the *x*-rays is absolutely indispensable.

CONCLUSIONS. *A. What x-ray examination furnishes in early tuberculosis of the adult.*

1. Infiltration processes at the apex, recognizable by percussion, which have a known extent, give a more or less deep shadow with the fluoroscope. The *x*-ray examination is frequently superior, as compared to the clinical, since it demonstrates that in many cases the process is more extensive than would be expected.

2. Infiltrations, either not demonstrable by percussion or only uncertainly so, can frequently be demonstrated by means of the fluoroscope; or when fluoroscopic results are doubtful, certainly by *x*-ray photography, diaphragm pictures. Besides, by this method it will not infrequently be shown that we are dealing with a more advanced case than was suspected.

3. The early stages of pure catarrhal processes are recognizable

neither by fluoroscopy nor by röntgenography. In long standing catarrh the results of poor aëration are seen with the fluoroscope as darker apices which do not clear up on inspiration. In important cases photography, in the shape of diaphragm pictures of the apices, should at once be employed. Beginning infiltrations are frequently recognized by this method which are not recognizable by any other.

4. The height of the apices, in doubtful cases determined by orthodiagraphic measurements, is only of importance when differences of 1 to 1.5 cm. exist. The width of the apices of the lungs has not yet been sufficiently studied röntgenographically to find employment diagnostically. Calcification of the first rib is well shown by diaphragm pictures, and according to Freund can be used as an aid in the diagnosis of incipient tuberculosis. The clearing of the apices with respiration, which is present in health, is frequently lacking on one or both sides in early tuberculosis. Movement of the diaphragm is altered in many ways; a unilateral lagging of the diaphragm on the affected side (Williams' phenomenon) cannot be classed as a special symptom, and, therefore, diagnostically is of no value. Orthodiagraphic measurements are needed. From a diagnostic standpoint the existence of rib shadows in *x*-ray pictures is either not to be taken into account at all, or if so, only with caution.

B. What x-ray examinations furnish in early tuberculosis of children and young people. In most cases apical findings are wanting; hence the recognition of shadow variations at the hilum are all the more important. These variations are due to bronchial glands enlarged as the result of induration, caseation, and calcification, and infiltration processes in the neighborhood of the hilum and bronchi. Frequently the picture of a central pneumonia following pneumococcic infections is seen in these conditions; then without fever the process, röntgenoscopically at least, slowly ad-advances, and after weeks is recognized as tuberculous, both by percussion, auscultation, and bacteriologically.

Furthermore, in well advanced pulmonary tuberculosis *x*-ray methods of diagnosis furnish very well, frequently surprisingly well, a supplementary picture to the clinical findings, both with the fluoroscope and with *x*-ray photography. By this method we often see that which we know by autopsy findings, namely, that the tuberculous process is considerably further advanced than we supposed from our clinical examination. If, as so frequently happens, an extensive peribronchial infiltration exists about the main bronchi of the lower lobe, a very characteristic picture is obtained with the fluoroscope. In addition, by means of *x*-ray diagnosis those infiltration foci which develop from the bronchial glands—clinically they often begin with the picture of a central pneumonia—are found and discovered with certainty. Moreover, they may be recognized positively as tuberculous if they are a direct continuation of the bronchial gland shadows, especially in the adolescent.

As a valuable addition to our methods of diagnosis, it is noteworthy that it is possible by means of the *x*-rays to recognize positively tuberculosis of the bronchial glands, which formerly we guessed at from the interpretation of the clinical picture. Calcified or chalky foci or glands are seen with remarkable clearness as well at the hilum as within the lung; frequently they are as sharply defined as foreign bodies. The recognition of indurated and swollen glands offers more difficulty. The first give a sharp picture with good diaphragming; their recognition requires practice above everything else. Medullary swelling or caseation of glands are only to be differentiated from lung tissue if the glands occur in large masses which project into the lighter lung tissue. I must emphasize, as an absolute necessity, in the *x*-ray diagnosis of bronchial gland tuberculosis, careful clinical observation with the aid of all known methods, the tuberculin reaction, etc. To be sure, the Röntgen picture will show an atypical or pathological condition at the hilum or in the pulmonary glands; but whether it is an active or passive process can only be determined through clinical observations.

We can diagnosticate cavities with great certainty with photographs, but, as a matter of fact, rarely with the fluoroscope. Those cavities can also be recognized which because of their deep position, are otherwise not amenable to diagnosis. That form of tuberculosis which first appears with the clinical picture of caseous pneumonia—dulness of lobar distribution, and loud bronchial breathing, often for a long time without catarrrh—gives a less intense shadow than croupous pneumonia. As a matter of fact, I have only been able to confirm this by autopsy in two cases.

THE TREATMENT OF TINEA TONSURANS.

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Few cutaneous diseases are more obstinate and stubborn to successfully combat than ringworm of the scalp. Because of the anatomical peculiarities in this locality, as well as the character of the usual infecting organism, it is much more difficult to bring about a cure here than in the bearded region. In the majority of instances (about 90 per cent.) Trichophyton microsporon (Audouini) is the hyphomycete which attacks the scalp. First becoming lodged in the stratum corneum, it multiplies there, giving rise to scaling and slight vesiculation. The growth then extends into the hair follicle and down the sides of that cavity, forming a sort of mosiac basket work encircling the bulb. Beneath this collar the cuticle becomes frayed and broken, probably as the result of the action of a kerato-

lytic ferment associated with the presence of the fungus, and allows the mycelium to penetrate into the body of the hair. Multiplication takes place both immediately beneath the cuticle and in the interior of the shaft proper. There is little if any pus formation, and the inflammatory changes in the perifollicular tissues are not, as a rule, marked. On the other hand, the lesions in deep seated tinea sycosis are almost invariably due to infection with the large spored ectothrix, and the tendency to inflammation and pus production, by both the plant itself and the ever-present pyogenic cocci, is very great. The tissues are loose and distensible, and a considerable reaction to the freely liberated toxins is quickly manifested, with resulting development of kerion-like, nodular masses. This process of stimulating the skin to destroy or throw off the fungus constitutes Nature's method of eliminating the disease, and it is a remarkably effective one. The same process is often instituted artificially, especially in those cases in which the scalp is involved, by the application of powerful irritants, such as formalin, chrysarobin, and croton oil. Needless to say, considerable care and skill are required in order to secure only the desired results. Permanent baldness of the affected area is not an infrequent sequel.

The direct method of treatment, in which entire dependence is placed on anti-parasitic remedies, such as sulphur, ammoniated mercury, and the various salts of copper, incorporated in diverse vehicles, is far safer, although extremely slow because of the difficulty experienced in getting the agent to penetrate the entire depth of the hair follicle.

In 1897 Schiff and Freund,[1] of Vienna, suggested the use of the *x*-rays as a depilatory agent, preliminary to the application of the antiseptic, and reported a series of cases successfully treated in this manner. Later, Hahn and Albers-Schönberg,[2] Kienbock,[3] Sabouraud,[4] and others also reported gratifying results, and at the present time the value of the measure is universally recognized. Where the rays are available this combined treatment is undoubtedly the one to be preferred. Sabouraud, who is one of its foremost exponents, gauges the radial dose by means of his "pastilles" (the radiometer of Sabouraud and Noire), and is consequently able to bring about epilation with from one to three exposures, thus minimizing the danger as well as the length of time required for a cure. Unfortunately his mode of procedure has not proved practicable in this country, probably because the indicators, which are manufactured only in France, deteriorate with climatic changes and the lapse of time.

The exposure must be of sufficient length to produce a slight

[1] Wien. med. Wochenschrift, 1897, p. 856.
[2] Münch. med. Woch., 1900, pp. 284, 324, and 363.
[3] Arch. f. Derm. und Syph., 1901, p. 132.
[4] Annales derm. et syph., 1892; "Les trichophyties humaines," Paris, 1894; "La Dermatologie Topographique," Paris, 1905.

reaction in the deeper layers of the skin and yet not great enough to set up secondary changes which will lead to atrophy of the papillæ and consequent permanent baldness. Inasmuch as the individual susceptibility to this rather imperfectly understood force varies considerably, the dividing line is not nearly so definite and clear cut as could be desired. In the absence of an uncomplicated, practicable instrument for measuring the quality and intensity of the rays, experience, coupled with a considerable working knowledge of the tube to be used, must be relied upon to secure the necessary result.

The employment of an energetic antiseptic, both before and for a considerable time after the hair is removed, is to be advised, otherwise the disease is almost sure to persist and continue to spread.

Although the rays exert no direct influence on the fungi, the reaction to which they give rise constitutes an inflammatory process which is destructive to the organisms, while the depilation of the infected hairs not only removes many of the hyphomycetes, but, most important of all, opens up new and essential avenues for the successful application of antiparasitic remedies. It was while in search of these latter, in May, 1907, that my attention was particularly drawn to this subject, and since that time I have been carrying on an intermittent series of experimental inoculations, rabbits being employed for the purpose. The first subject (No. 1) was a male white rabbit, and it required repeated efforts, extending over a period of eleven weeks, to infect him successfully with a small spored ringworm obtained from the hair of a four-year-old patient in the University Clinic. After this experience I confined my attention, in animal experimentation, to the ectothrix.

The two affected patches which finally resulted were roughly oval in outline and measured 0.5 x 1.5 and 1 x 2 cm. One was on the right hip, the other above and in front of the right flank. Both were covered with a short, irregular stubble of broken hairs, the interstices being crowded with fine, grayish white, powdery scales.

There were no inflammatory areolæ, and very little vesiculation. The lower patch, including a 1 cm. margin, was surrounded with lead foil and subjected to an eleven-minute exposure from a Piffard model cancer tube at a low vacuum, the window being placed 6 cm. from the area. Under like conditions a ten-minute exposure is generally sufficient to bring about the desired result on the human scalp.

Ten days later, in the absence of any perceptible reaction, a second exposure, of twelve minutes, was given. Fifteen days after this the long hairs surrounding the area became loosened and commenced to fall out, denudation being complete at the end of a week. The resulting bare surface was equally divided, from above downward, by a line drawn with a sharp-pointed indelible pencil, and the anterior half thoroughly covered with the following mixture: Iodine crystals, 1.75; potassium iodide, 1.25; goose grease, 25.

¶ In explanation I will say that for a considerable time both my associate, Dr. Kanoky (with whom the idea originated) and I have been employing a combination of iodine and mercury for topical antisepsis with most excellent results. The ordinary tincture of iodine is first mopped on the surface, and this is followed, a few minutes afterward, by the application of a 2 per cent. aqueous solution of mercuric chloride. The powerful effect secured is due not to the individual action of either agent alone, but to a third, mercury iodide, an extremely active and powerful, but relatively unstable, salt which is formed at the points of contact.[5] In a previous series of experiments on animals I demonstrated the superior value of goose grease as a skin penetrant.

A portion of each half of the bald spot was excised, under chloroform anesthesia, fastened in a wooden vise microtome block, frozen by means of the ethyl chloride spray, and sectioned in a direction as nearly parallel as possible with the follicles and from below upward. The bits of tissue were immediately transferred to a filtered solution of strained honey (10), glycerin (20), and water (70), and later examined in the same media. Unfortunately, owing to the method of cutting, the sections were too thick for finer differentiation with the oil immersion, and the lenses employed (Ocular 4 and Objectives 4 and 9, Reichert) failed to reveal any inflammatory changes. It could be seen, however, that the iodine

[5] The reaction which takes place is explained, by Prof. Roy Cross, A.M., M.D., of the Department of Chemisty, as follows:

Formula, No. 1.		Formula, No. 2.	
KI	5	$HgCl_2$	2
I_2	7	Goose grease	100
Goose grease	100		

In No. 1 the iodine dissolves in the goose grease and the KI is mechanically mixed with it. In order that a reaction may take place, a common solvent must be present, and this is furnished by the skin when the ointment is applied. The KI solution then takes up its equivalent of iodine as is present in the formula (see reaction (I) and note *a*).

When the $HgCl_2$ ointment is applied in quantity equal to or greater than No. 1, the complex salt, potassium mercuric iodide, and iodine are formed. The final active agents are practically the K^+ ion, the complex HgI_4^{--} ion, and the molecular iodine. The reactions, with their general mechanism, follow:

(I) $K^+ + I^- + I = K^+ I^-$ ((see note *b*)—the c's represent concentrations.

$c_1 \quad c_2 \quad c_3$

$$\frac{c_1 c_2}{c_3} = \text{a constant (according to the mass law).}$$

(II) $Hg^{++} + 2Cl^- 4K^+ + 4I^- = 4K^+ + 2Cl^- + HgI_4^{--}$ $\frac{c_4 c_1^4}{c_5}$ a constant

$c_4 \qquad c_1 \qquad c_3$

(from mass law).

When ointment No. 2 is added reaction (II) takes place and c_1, in both mass law equations, is diminished. Therefore c_2 is increased, or, in other words, molecular iodine is formed.

Note *a*.—See laws of distribution—Oswald, "Grundlinien der Inorganische Chemie;" also Nernst, "Theoretical Chemistry."

Note *b*.—KI is practically completely dissociated into K ions and I ions in solution, and its properties are dependent upon these ions.

mixture had penetrated to the bottoms of practically all the follicles in the treated area, as well as to a considerable depth in the appended glands. Quite a number of fungi remained in the cavities, along with small portions of broken hair cuticle, and their presence explained the frequency with which re-infection occurs, even when all of the shafts have been removed.

On June 3, 1907, the upper patch, which had not been rayed, was treated with the iodine-goose grease mixture, heat (from a 50 C. P. focussed incandescent lamp) and friction being employed. A half-hour later a 2 per cent. solution of mercuric chloride in goose grease was applied. This gave rise to a slight degree of irritation, which subsided about four days afterward. The application was repeated on the 10th and 17th. On June 30 the patch showed decided signs of improvement. Unfortunately, I had to leave the city and did not see the rabbit again for two months. At that time the skin was apparently normal macroscopically, and it was not possible to outline the former affected area.

In the latter part of September I was able to secure some excellent specimens of the ectothrix from an extensive case of ringworm of the body, the disease having originally been contracted from a pet kitten. The non-cultural differentiation of the corporeal types in man can best be made, as White has pointed out, by the examination of an infected lanugo hair.

Two white rabbits were shortly afterward successfully inoculated from these scales. In both animals the affected areas showed a much greater tendency to become raw and inflamed than in rabbit No. 1. Animal No. 2 developed a large, irregular patch on the right upper shoulder, a smaller, almost circular one on the right flank, and a third, roughly oval in shape, on the left side of the trunk. The area on the shoulder was depilated by one fourteen-minute exposure from the Piffard tube, denudation being practically complete at the end of two weeks. The bare surface was given a thorough coating with the iodine-goose grease mixture, followed by the corrosive sublimate. Three days later a portion from the centre of this patch was excised, prepared for sectioning, mounted in celloidin, cut, and stained by the Unna-Pappenheim method. The signs of inflammation, both in the walls of the follicles and the perifollicular tissues, were not very marked; in fact, the changes were not greater than one would expect to find in ordinary, untreated, ring-worm infected tissue. From these and similar findings made subsequently I judge the curvative effects of the mercurial salt are due more to its antiseptic properties than to its action as an irritant.

The infected area on the left side of No. 2 was given an exposure of fifteen minutes, the patch in the right flank being treated with the iodine and mercury solutions at the same time. On the twelfth day following, the skin on the left side showed considerable evidences of inflammation and many of the hairs in the rayed area could be

readily extracted from their follicles. The loosened shafts were removed as thoroughly as possible by friction and the separate antiseptics well rubbed in. In the meantime the spot on the flank had received four treatments with the solutions, both heat and friction being employed. All medication was discontinued on November 15.

Hair development was slow in the depilated area. My notes record, on January 18, the appearance of "a fine lanugo-like growth scattered over the surface," and the outline could still be plainly discerned two months later.

The patch in the right flank improved quite rapidly, almost from the time treatment was first instituted. It still appeared a trifle "moth eaten" on January 1, but was apparently normal four weeks later, an examination of hairs and curette scrapings proving negative.

The disease manifested itself rather slowly in No. 3. Only two patches developed, and in both it seemed as if the organisms confined their attack mainly to the outer layers of the epidermis. There was some hair involvement, however, in addition to very considerable scaling and the formation of numerous minute vesicles, the latter being especially plentiful around the openings of the follicles. The *x*-rays were not used on this animal, four applications of the antiseptic, at three day intervals, being sufficient to bring about a cure. A similar satisfactory result was secured in the case of a fourth rabbit, infected in March, 1908, with the ectothrix.

In five clinical cases, all children, treated with the mixture since February 1, the results have been very satisfactory. The microsporon was the causative fungus in each instance.

One of these patients, a girl of five years, presented the most intractable example of the disease that I have ever encountered. The scalp was attacked at ten or a dozen different points, and new patches were developing and the old ones extending in spite of treatment. This was due, in a large measure, to the neglect of the mother, who failed to carry out the instructions given her. The affected areas were finally depilated (by the fractional method of Sabouraud) and the disease checked, and ultimately eradicated, by the use of the iodine-mercury solutions. While I have never seen any untoward effects following the employment of these drugs, care has always been exercised not to cover too large a field at one time, 30 or 35 square centimeters being about the limit for a child of eight years.

No one realizes better than I the dangers of generalizing from a too limited experience or from insufficient data, but the excellent results secured by this method of treatment, especially in the earlier stages of the disease or as a postdepilatory measure, certainly speak strongly in favor of its routine use in this extremely intractable affection.

REVIEWS.

DISEASES AND SURGERY OF THE GENITO-URINARY SYSTEM. By FRANCIS S. WATSON, M.D., Lecturer on Genito-urinary Surgery in the Harvard Medical School. Assisted by JOHN H. CUNNINGHAM, JR., M.D. 2 vols.; pp. 1101; 454 engravings and 47 colored plates. Philadelphia and New York: Lea & Febiger, 1908.

IN THE accomplishment of his purpose to write this book the senior author labored—like Jacob for Rachel—seven years, but, more fortunate than the patriarch, was able to secure a collaborator for the last three. The outcome is a useful addition to the literature of genito-urinary surgery, an excellent compendium of modern opinion on that subject, and a reliable guide to the operator, partly through the numerous statistical tables of mortality—and other—results, but chiefly by reason of the careful descriptions of the details of approved operative methods.

Volume I deals with the external genitals, prostate, and bladder. The article on chancroid is brief, but satisfactory, though some rather antiquated and space-consuming tables of Fournier's might, with advantage, have been omitted.

The article on cancer of the penis is an abstract of a paper by Barney.[1] A certain carelessness is shown in the arrangement of this material. Under the heading, "Contact with Cancerous Cervix," Barney says: "In this series"—meaning his whole series of 100 cases—"there was not even a suggestion of this being an etiological factor." Later, under "Nationality," he says: "It is worthy of note that the Jewish race does not figure in this list of nations." Watson runs these two statements together under the former heading, with the result, in effect, of asserting, first, that *no one* acquired penile cancer from contact with a cancerous cervix; next, that no Jews acquired it in that way! The matter is worthy of mention because it renders obscure an important and significant clinical fact with an obvious bearing, not only on penile cancer, but also on circumcision and on the causation of cancer in general. In this relation, too, may be noted the use, between quotation marks, of an

[1] Annals of Surgery, December, 1907.

excerpt (page 52) from the same article, but with omissions that are altogether unindicated. This occurs elsewhere (*e. g.*, p. 341) more than once. In every case the omissions have obviously been made for the sake of brevity, and no perversion of meaning has resulted; but the custom is indefensible. A quotation altered in any respect should invariably have such changes indicated in one of the usual ways. In the second example mentioned the result is a paragraph of slovenly English that the writer quoted from would certainly prefer to repudiate, and in the above instance Dr. Barney's omitted figures give point to the otherwise bald statements as to modes of origin.

The text might here and there be bettered as to lucidity. Thus, in discussing the interesting instances in which in the absence of doubtful intercourse—or even of any intercourse—the gonococcus is apparently present in the discharge of a urethritis, the authors describe such a case as one in which "the patient has not had sexual connection and could not have had it for so long a time previous to the appearance of the disease as to make a gonorrhœal contagion possible." This surely might be improved upon as to clearness; "within such a time" would perhaps be preferable. We would not refer to an "occult reason as yet unknown" (p. 60), or say, "this picture is a very different one from the violent course pursued," etc. (p. 73), or "the practice and special knowledge demanded . . . is too great" (Vol. II, p. 181); nor would we write, "White and Martin speak as follows: They say," etc. (p. 58); we would similarly prefer not to split the infinitive—"to absolutely interdict" (p. 62), (though we know Professor Lounsbury's views on that subject); and we certainly would not say, in writing of gonorrhœa, that "we *personally* prefer the ordinary urethral syringe for the acute stage of the disease" (p. 64), (the italics are ours), though we would cordially join in a preference not thus qualified. The expression seems a favorite one, as the writers say of the treatment of gonorrhœal lymphangitis, "Personally we do not believe in cold applications" (p. 67). Throughout there is some similar looseness of expression to be found—if sought for—but it would be hypercritical to lay much stress upon it.

Undue confidence is expressed in sandalwood oil and in argyrol in the treatmeat of specific urethritis.

Somewhat more recent statistical—and other—information as to gonorrhœal ophthalmia might be obtained than by reference to Keyes for the old figures of relative frequency (14 to 1), as compared with gonorrhœal conjunctivitis, which were quoted from Fournier by Van Buren and Keyes in 1877, and have been requoted ever since. The treatment recommended (quoted from Keyes, who quotes from Knapp) in the latter and graver condition fails to mention the great importance to others of immediate isolation of the patient.

The views of Dr. Otis with respect to urethral caliber are accepted as accurate by the authors. Many surgeons are now convinced that the relationship between the circumference of the flaccid penis and the urethral caliber is much less definite than Otis supposed, and that his figures are exaggerated and distinctly misleading when the urethrameter is used for diagnosis in the penile urethra, and its findings interpreted by his scale. We saw no mention of the similar errors in diagnosis that may result from the use of the bougie-á-boule in the deep urethra. In both cases normal narrowings may be—and frequently are—mistaken for strictures.

The teaching that divulsion "should have no place in the treatment of strictures" is so sound that it might have sufficed. It is weakened by the publication of a mortality table (including the figures of Holt—circa 1861), which *seems* to show that the operation "is neither more nor less safe than internal urethrotomy." To estimate the value of such tables it is sufficient to recall that in 1861 the use of urinary antiseptics by the mouth was unthought of as a preparation for operations on the urinary tract. Periods should be compared as well as cases. This is an example of a tendency often noticeable among statisticians. The habit of collecting figures not unnaturally seems unsatisfying unless conjoined with the habit of generalizing upon them. The author was awake to the danger of this when he wrote his preface, but he has nodded occasionally while preparing his text. It is to be remarked, with approval, that in the face of the too prevalent disposition to elaborate most surgical procedures, and to throw aside old and well-tried methods, he has had the courage to say that in hydrocele "the simplest and a very effective method of treatment is that of injecting the sac with carbolic acid or tincture of iodine."

The suggestion is made as to the cause of prostatic hypertrophy—that "the best, perhaps, that can be said is that at or after middle life the greater number of persons exhibit a tendency to fibrous formations of one or another structure of the organism, and that among these a very common one is that of the change which affects the prostate, although the changes are not confined to the connective tissue of the gland." This is both weak in theory and confused in language. It must be admitted that we can only guess on this subject, but to suggest that the underlying cause is a certain tendency to "fibrous formation," and then state—correctly, of course—that the prostatic growth is not merely such a formation, would seem, in the slang of the day, to entitle the authors to "guess again."

The subject is thereafter treated with much fulness and perspicacity, but the claims of perineal prostatectomy are presented in a too favorable light, and its disadvantages somewhat too lightly touched upon, while the very positive teaching in its favor rests largely upon a series of figures, some of which are repetitions and have no cumulative value, and all of which are undergoing change

as more and more cases are reported. Dr. Watson may be right, but he doesn't prove that he is.

His treatment of the chief foreign exponent of suprapubic enucleation, Mr. Freyer, seems more discourteous than is warranted by any facts with which the reviewer is familiar. To call Mr. Freyer a "universal usurper of previously preëmpted prostatic privileges" (p. 342) is cheap and undignified, and seems to display a bias that lessens whatever value the opinion of the author as to the controversy about "priority" might otherwise have. Moreover, it is tautological, as no usurped preëmpted anything could be other than "previous" in point of time. The mention of the beginning of Mr. Freyer's work—(he went to London after resigning from the army and leaving India)—as his "somewhat spectacular entrance . . . upon the scene" (p. 339), similarly suggests an attitude at least unjudicial. Caspar says, after mentioning Fuller and Watson: "In 1900 Mr. P. J. Freyer, of London, adopting and modifying the principle of Fuller's method, began the series of operations which have connected his name with suprapubic prostatectomy." (Second edition, p. 366, 1909.) That seems on its face a statement more likely to carry weight.

If it was worth while, for purposes of comparison, to publish mortality tables of castration and vasectomy, there is no good reason why the earliest tables (White's and Cabot's)—210 cases with a mortality of 16.2 per cent.—should have been selected, and the later one of Wood—159 cases with a mortality of 8.1 per cent.—should have been ignored. In the same relation a mortality of 8.3 per cent. is assigned to vasectomy, although Wood's and Rovsing's 233 cases show 13 deaths, a mortality of 5.5 per cent. If "conclusions" are to be drawn from figures—as in these instances they are drawn—it is obvious that the figures must be reliable.

The chapter on vesical calculus is a good *resume* of the subject. Among the possible contra-indications to litholapaxy might have been mentioned: marked chronic cystitis; calculi with an uncrushable nucleus, such as lampwick; great atony of the bladder. It is difficult to see the advantage—in a book in which the surgery of the genitalia, bladder, and prostate is considered in only 599 pages—of devoting so much space to cuts of instruments. There are no less than seven cuts of evacuating pumps, including Bigelow's, Otis', Keegan's, Freyer's, Thompson's, Bird's, and an anonymous one, although the author expresses the sound opinion that none of them has materially improved upon Bigelow's original device.

Volume II, dealing with the kidneys and ureters, is an interesting and valuable portion of the book. The reason assigned by the author (following Glantenay) for the occurrence of movable kidney, viz., defective development of perirenal connective-tissue attachments to surrounding parts, although much emphasized as the "only explanation" with respect to etiology which "covers the

ground," seems altogether inadequate. In most cases such defect would certainly be incapable of demonstration as a precedent condition, and its existence would have to be assumed. The hypothesis does not explain the preponderance of right-sided cases (13 to 1), or the greater frequency in females (8 or 10 to 1). The argument that the downward pressure of the liver helps to account for the greater frequency on the right side is met with the curious statement that "it certainly does not explain the left kidney cases, and does not account for the right ones, else why should not all right kidneys be abnormally mobile?" The greater fixation of the left kidney, due to the fibrous bands which result from the fusion of the primitive parietal peritoneum and the surface of the primary descending mesocolon, is ignored. The author deals with the various factors generally accepted as contributory to undue mobility of the kidney in the same way; for example, rejecting the view that the shape of the renal—paravertebral—fossæ helps to account for both right-sidedness in all cases and the greater frequency in women (a view strengthened by the observations and dissections of Harris) because he has seen a movable left kidney in a young man "whose left paravertebral fossa was quite as deep and quite as well closed as is the case in subjects in whom there has been no such abnormal mobility of the organ."

The article on renal infection and suppuration is an admirable one. The diversity of opinion, to which he calls attention, as to "the relative frequency of unilateral and bilateral hematogenous renal infection or suppurative nephritis" is due in part at least to the assumption that the terms are ordinarily used as synonyms. He so uses them, but we do not believe this to be the rule. If suppurative nephritis is not of hematogenous origin—as it frequently is not—it is, of course, much more likely to be unilateral.

"Perinephric" abscess seems to us a better term than "perinephritic," as true inflammation may be absent (as in some tuberculous cases), or an abscess may have become "perinephric" by gravity and in the absence of any primary infection of perirenal tissues.

The chapter on renal calculus, that on renal and adrenal tumors, and that on genito-urinary tuberculosis, are worthy of careful study. In relation to tuberculosis of the epididymis and testicle, the author, after confessing that he is still in much doubt as to the rules that should govern the choice between palliative (or expectant) and operative treatment, gives a summary of the results of Bruns, and says, finally, that he "inclines to the opinion that it is a mistake to remove either or both testicles, except for the sake of cleanliness and comfort in the cases in which there is distressing open ulceration or suppuration, and to advise hygienic, tonic, and outdoor treatment for the larger number of these patients." If he means that he inclines to advise such treatment—and not that it is a mistake

to do so—we agree with him and believe his opinion to be sound and not unduly conservative.

The illustrations are of varied quality; some of the most ambitious (especially those in color) are flamboyant and impressionistic, and convey but little idea of the conditions supposed to be represented; others are too wooden and characterless. The general level, however, is high, and many of them—though diagrammatic—are models of what explanatory cuts should be. The anatomical plates—taken largely from standard authors—are good, as a rule, while the reproductions of the appearance of specimens are uniformly beyond criticism.

The book shows—with some exceptions such as those to which attention has been called—much care and industry in its preparation, and indicates throughout the undoubtedly extensive experience on which it is based. It fairly represents modern thought and modern practice, and goes far toward justifying the expectations of the friends and colleagues of the authors. In most of its mechanical features it could scarcely be improved upon. It deserves a place in the library of every genito-urinary surgeon. J. W. W.

Diseases of the Skin and the Eruptive Fevers. By Jay Frank Schamberg, A.B., M.D., Professor of Dermatology and Infectious Eruptive Diseases in the Philadelphia Polyclinic and College for Graduates in Medicine. Pp. 534; illustrated. Philadelphia and London: W. B. Saunders Company, 1908.

The author begins well by clearly defining dermatology as embracing "in its broadest sense the consideration of all morbid processes that are characterized by cutaneous manifestations," thus distinguishing this important branch of general medicine from the domain of the self-styled, petty "dermatologist," in which "facial blemishes," moles, corns, and warts constitute the principle diseases. Dermatology rightly defined is really an important branch of medicine. The work before us, though far from being a treatise, nevertheless portrays briefly and tersely the most important points in connection with each disease. The style is concise and practical, so that the reader who follows the text (too brief, as it sometimes is) and the numerous and excellent photographic illustrations should not fail to comprehend at least the elements of dermatology as the author understands and uses this term. Some of the chapters might have been fuller and others shorter; thus, the anatomy of the skin and the general symptomatology receive only a few pages, while general etiology is not touched upon. On the other hand, eczema, acne, and psoriasis receive sufficient space, consider-

ing the size of the volume. The "acute eruptive fevers" occupy, perhaps, one-third of the entire book, and constitute a valuable contribution, the statements made emanating from one who has studied these diseases in a practical and thorough manner from the standpoint of cutaneous medicine. There is also a chapter devoted to "acute infectious diseases, accompanied at times by eruptions," such as typhoid and typhus fevers, influenza, epidemic cerebrospinal meningitis, rheumatic fever, serum eruptions, and the like.

The nomenclature employed throughout is sensible, plain, and in harmony with most authors in this country. The term syphiloderma, we are pleased to observe, is employed in preference to the unsatisfactory French "syphilide," so often used, a word which should never have been permitted to find lodgement in an American or English text-book. The views expressed on all topics are conservative, safe to follow, and practical, and are well abreast of the knowledge of the present time, both as to general and special pathology, etiology, and treatment. Actinotherapy and radiotherapy receive considerably more than passing notice. Many rare diseases are briefly described, some with photographs, which, of course, add greatly to the value of the remarks. The illustrations throughout the book are largely original, and have been taken by the author, so well known for his skill in this field. The novel feature of the work, for a book of its size, is the consideration together of the non-febrile and the febrile cutaneous diseases, though this plan was successfully carried out fifty years ago by Hebra in his exhaustive and valuable treatise on diseases of the skin. L. A. D.

NERVOUS DISEASES AND PSYCHIATRY. By CHARLES L. DANA, M.D., LL.D., Professor of Nervous Diseases in the Cornell University Medical School, New York. Seventh edition; pp. 782; 264 illustrations. New York: William Wood & Co., 1908.

THE publication of the seventh edition of a book on a special subject, like neurology, is perhaps the best commendation that reasonably can be hoped for. The forelying issue of Dr. Dana's book contains not only the best of those that have gone before, but also additions to the sections on the histology of the neuron and the anatomy and physiology of the brain; re-arrangement and amplification of the sections on neurasthenia, hysteria, psychasthenia, and the methods of psychotherapy; and expansion of the sections dealing with neuritis, tabes, multiple sclerosis, brain tumor, the tics, and paralysis agitans. The book has long enjoyed an enviable reputation as one of the best moderate-sized treatises on neurology; the new edition, somewhat enlarged, considerably revised, in part rewritten, and enriched by many new illustrations, unquestionably will find added favor in professional eyes. A. K.

THE MEDICAL AND SURGICAL KNOWLEDGE OF WILLIAM SHAKSPERE. WITH EXPLANATORY NOTES. By JOHN W. WAINWRIGHT, M.D. New York: Published by the author, 1908.

DR. WAINWRIGHT has collected a very interesting series of 135 or more quotations from Shakspere that show his wide range of matters medical, if they do not suggest that the Bard of Avon actually studied medicine. The quotations embrace references to anatomy, physiology, medicine, surgery, obstetrics, neurology, psychiatry, therapeutics, dietetics, hygiene, ethics, jurisprudence, toxicology, and pharmacy. With some of the quotations we are tolerably familiar; others have long since passed without our ken; others are new. All have been drawn from unexpurgated early editions, and have been materially enhanced in value and interest by explanatory comments by Dr. Wainwright. There is a photogravure of the only authentic portrait of Shakspere painted during his lifetime. Assuredly Dr. Wainwright's labor of love has been worthily accomplished; the book should prove a welcome addition to any library.

A. K.

ÉTUDE SUR LES CONTUSIONS, DECHIRURES, ET RUPTURES DU REIN (STUDY OF CONTUSIONS, LACERATIONS, AND RUPTURES OF THE KIDNEY). By DR. GEORGES LARDENNOIS, Prosecteur à la Faculté de Médecine de Paris. Pp. 230; 22 illustrations. Paris: G. Steinheil, 1908.

THE author's object in preparing a statistical study of nearly 800 renal injuries, 4 of which cases came under his own observation, was to determine the indications for operative interference. Until about 1900, surgeons in general were very conservative in their views of the proper treatment of these injuries; operation was recommended and adopted only as a last resort. Since that time, and up to the present, there have been done, in the opinion of Lardennois a quite unnecessary number of nephrectomies for rupture. He finds, however, that early operation is attended by a lower mortality than if operation be postponed or not adopted at all. Among 666 cases in which the latter course was adopted, the mortality was 28 per cent., whereas among 102 patients treated by prompt operation, only 18 per cent. died, and as all the more serious injuries are included in the latter series, the difference is more striking than the actual figures indicate. Moreover, if from the above figures one excludes all cases in which complicating lesions rather than the injury of the kidney caused death, it is found that the death rate following expectant treatment was 25 per cent., while that after prompt operation was only 10 per cent.

He insists on the necessity of determining whether or not the kidney is ruptured at the earliest possible moment. Delay in reaching a decision may render adoption of proper treatment impossible. The main indication for operative intervention he thinks is the presence of a lumbar hematoma, especially if increasing in size; he regards this as a much more imperative indication than hematuria, which, comparatively speaking, is benign unless so profuse as to be accompanied by signs of very grave anemia. Among 59 early nephrectomies there were 14 deaths. So radical an operation is rarely necessary, and we think he quite properly urges suture and packing as preferable in almost all cases; for even though the uninjured kidney will undergo compensatory hypertrophy, and although the ruptured organ may be functionally equivalent, when cicatrized, to not more than one quarter of a normal kidney, yet it is well worth while to save even that much of a kidney for the patient.

A. P. C. A.

SUBCUTANEOUS HYDROCARBON PROTHESES. By F. STRANGE KOLLE, M.D. Pp. 153. The Grafton Press, New York, 1908.

SUBCUTANEOUS injections of paraffin for the correction of deformities of the face and other exposed parts of the body have become such a recognized method of surgical treatment that it is well to have the indications and the limitations of this method clearly defined. This the author appears to have done in the present volume. He recognizes the dangers and deficiencies of the method when ignorantly or carelessly applied, but takes pains to show how these may be avoided. He prefers paraffin with a low melting point, from 102° to 115° F.; and he makes the injections with the paraffin cold, using a specially constructed syringe, which by the screw action of its piston forces the paraffin out in a thread-like stream. These precautions prevent embolism, burning, excessive inflammatory reaction, etc. He insists on the necessity of injecting only a small amount at a time, and in no case attempting to overcorrect the deformity. This prevents subsequent sloughing and the necessity for the removal of the mass. He uses neither general nor local anesthesia, except in a few cases the ethyl chloride spray. He does not describe, and apparently does not commend the use of paraffin prothesis for the deformities left after excisions of the jaw, etc. There are some evidences of carelessness in writing, such as the expression "*vice a tergo*" (p. 61), and the statement (p. 3) that among the advantages of the so-called Gersuny method are the difficult surgical interferences entailed, and the subsequent unsightly cicatrices. These, no doubt, will be corrected in another edition.

A. P. C. A.

A Manual of Diseases of the Nose and Throat. By Cornelius Godfrey Coakley, A.M., M.D., Professor of Laryngology in the University and Bellevue Hospital Medical College, New York. Fourth edition; pp. 604; 126 engravings and 7 colored plates. New York and Philadelphia: Lea & Febiger, 1908.

The present edition of this excellent manual has been carefully revised and some notable additions made to it. Thus, the section on diseases of the septum contains a concise but clear description of the submucous operation for deflections of that structure. We are glad to notice that Dr. Coakley still considers the guillotine of service in the removal of hypertrophied tonsils. Although tonsillectomy is undoubtedly the operation of choice in the majority of cases, nevertheless the guillotine has still a wide field of usefulness. It must be remembered that the guillotine is generally considered a very easily used instrument, and as such is used by many who never acquire the technique necessary for its proper employment. The reviewer thoroughly agrees with Dr. Coakley in his statement that it is a most excellent instrument for the removal of non-adherent tonsils. It is to be hoped that, in his next edition, Dr. Coakley will include an account of direct laryngoscopy and bronchoscopy, as these procedures have now been established on the basis of practical usefulness. We know of no other book of this class which can be more highly commended as a safe and reliable guide to the student of laryngology and rhinology. F. R. P.

A Manual of Psychiatry. By J. Rogues de Fursac, M.D., formerly Chief of Clinic at the Medical Faculty of Paris; Physician-in-Chief to the Public Insane Asylums of the Seine Department. Authorized Translation from the French. By A. J. Rosanoff, M.D., Second Assistant Physician, King's Park State Hospital, New York. Second American edition. Pp. 406. New York: John Wiley & Sons; London: Chapman & Hall, Limited, 1908.

This is the second American edition of this work, the first one having been published in 1905. The previous edition was edited by Dr. Joseph Collins. The entire text has been thoroughly revised and all of the author's additions in the second French edition have been introduced. This book does not differ very much from the usual manual of psychiatry. As is customary, the first part is devoted to general principles, such as etiology and symptomatology, and the second to special psychiatry. With a few exceptions,

Krapelin's classification is adopted. The manner of treatment is very good, and the subject matter is briefly and well set forth. Besides, the translator, who has done his work very well, has added notes on psychotherapy, the after-care of the insane, and the technique of lumbar puncture. Altogether, it is a good book for the beginner. T. H. W.

ANATOMIE UND MECHANISMUS DER SKOLIOSE. By DR. CARL NICOLADONI. Pp. 58; 37 plates (54 figures). Berlin: Urban und Schwarzenberg, 1909.

THE chief value of this little book, issued in pious remembrance of its author by his sister, and with a brief word of introduction by Hochenegg, lies in the admirable plates which fully illustrate the effect of torsion and rotation in the production of changes in the vertebræ and in their relation to one another. They show successively the topography of the thoracic and abdominal viscera; the changes in fasciæ and in the diaphragm; the alteration of the spine in different planes—horizontal, frontal, and sagittal; and the effects of lumbar scoliosis on the column and on individual vertebræ. A very brief summary and a bibliography of the literature of the anatomy and mechanism of scoliosis are added. The author's views as to predisposition, torsion, rotation, etc., are confirmed by these excellent illustrations. It was worth while to preserve and produce—even six years after the author's death—this valuable record of painstaking research into the fundamental causes of lateral curvature. J. W. W.

INSOMNIA AND NERVE STRAIN. By HENRY S. UPSON, M.D. Pp. 142. New York and London: G. P. Putnam's Sons, 1908.

THIS volume deals with the effect of peripheral irritation on the central nervous system, and its influence on the production of various neuroses. The first half of the book is devoted almost entirely to case records of melancholia, mania, dementia præcox, hysteria, and neurasthenia. Examples of all these diseases are presented as cured following the removal of irritation from disease of the teeth. Many of the case records are incomplete, and the facts presented therein are insufficient for a diagnosis. This is more particularly the case in the examples of melancholia and dementia præcox. Nothwithstanding these discrepancies, the results obtained from such a simple procedure as the proper examination and care of the teeth are rather startling. The second half of the book is a

psychological analysis of the neuroses. Nothing new is brought out; the analyses are poorly presented, and for the most part are not at all consistent with the accepted physiology of the cell and the nervous system. The subject matter presented in the volume would have made a good paper; presented in book form, it is somewhat disappointing. If it leads to a closer study of the teeth in conditions of lowered nerve tone, it will perhaps serve a useful purpose. D. J. McC.

PATHOLOGICAL TECHNIQUE. A PRACTICAL MANUAL FOR WORKERS IN PATHOLOGICAL HISTOLOGY AND BACTERIOLOGY, INCLUDING DIRECTIONS FOR THE PERFORMANCE OF AUTOPSIES AND FOR CLINICAL DIAGNOSIS BY LABORATORY METHODS. By FRANK BURR MALLORY, A.M., M.D., Associate Professor of Pathology in the Harvard University Medical School; and JAMES HOMER WRIGHT, A.M., M.D., S.D., Assistant Professor of Pathology in the Harvard University Medical School. Fourth edition; pp. 480; 152 illustrations. Philadelphia and London: W. B. Saunders Co., 1908.

IT is scarcely necessary to say anything in review of this excellent work, which has reached its fourth edition. The subject matter is treated with extreme clearness, and with such brevity as is possible in a book of its kind. Some of the improvements and additions that deserve mention are: the incorporation of Zinsser's anaërobic method for plate cultures, and three new methods for the cultivation and differentiation of the typhoid bacillus, the ox-bile method, the medium of Endo, and the malachite green method. The paragraphs on actinomycosis have been entirely rewritten and several excellent photographs have been added. Weigert's iron hematoxylin stain for nuclei; improved methods for staining fibroglia, myoglia, and neuroglia fibrils; Wright's method for the differential staining of blood platelets and the giant cells of the bone marrow; Best's improved stain for glycogen; von Kossa's silver method for demonstrating lime salts; staining methods for Treponema pallida; and Sir A. E. Wright's method of preparing bacterial vaccines, have also been added. As a standard book for laboratory workers in general it can be highly recommended. J. A. K.

PROGRESS

OF

MEDICAL SCIENCE.

MEDICINE.

UNDER THE CHARGE OF

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Aortic Insufficiency and Lues.—CITRON (*Berl. klin. Woch.*, 1908, xlv, 2142) reviews the literature of aortic insufficiency and aortitis, and points out that the histological examination of the aorta in suspected luetic disease has thus far failed to reveal the presence of Spirochæta pallida. The frequency of aortitis in lues is, however, so great that a causal relationship must be assumed. Citron has reviewed the histories of patients with aortic insufficiency admitted to Professor Kraus' clinic in the past four years, and finds that only 14 per cent. gave a definite history of syphilis, while about 26 per cent. were suspected of having had the disease. In the past year and one-half the Wassermann reaction has been tried on all patients with aortic insufficiency, and of 19 cases it was positive in 11. In cases of pure aortic insufficiency—16 in number—10 gave a positive reaction. Without attempting to draw far-reaching conclusions from his few patients, Citron believes it safe to say that lues is a much commoner cause of pure aortic insufficiency than the history and clinical findings would lead one to suspect. Especially in all patients in whom acute articular rheumatism has not existed lues must be considered, but his cases have shown that a positive reaction may be found in instances in which acute articular rheumatism, lead poisoning, alcoholism, and abuse of tobacco were present and thus probably aided in producing the changes in the aorta.

The Substances causing High Pressure in the Blood of Nephritics.—SCHLAYER (*Münch. med. Woch.*, 1908, lv, 2604) had previously reported negative results on examining the blood of nephritics for adrenalin by the method of O. B. Meyer, which consists in the use of arteries obtained fresh from the ox. He found that the blood of nephritics caused even less contraction in the fresh artery than normal blood, whereas one should

expect a greater contraction if the adrenalin were increased in the blood. With the enucleated frog's eye mydriasis is the rule with nephritics blood. In an attempt to control these apparently contradictory results, Schlayer resorted to experiments upon animals. He produced an adrenalin anemia by slow infusion of adrenalin in salt solution. By this means an increased amount of adrenalin was brought into the blood, as was shown by the mydriasis in the frog's eye. On testing this blood with fresh artery from the ox he found that there was less contraction of the artery than with normal rabbit's blood, a result analogous to that obtained with the blood of normal individuals and those suffering with nephritis. On adding adrenalin to ox blood and then testing the blood with an artery, an opposite result was obtained, the adrenalin blood causing a much greater contraction than normal ox blood. From this and other experiments he was able to demonstrate that an increased amount of adrenalin in the blood would only react to a fresh artery when both blood and artery were obtained from the same species. He concludes, therefore, that the Meyer test is misleading when the artery of an ox is used for testing the blood from any other animal. This probably explains the contradictory results in patients suffering with nephritis and re-opens the question as to whether adrenalin is increased in the blood in these patients.

The Demonstration of Parasites in the Blood.—Stäubli (*Münch. med. Woch.*, 1908, lv, 2601) demonstrated some time ago that trichina embryos are easily found in the heart blood of experimental animals, if one adds to the blood 3 per cent. acetic acid to lake the red cells and then centrifugalizes the specimen and examines the sediment, which contains leukocytes and any embryos which are present. More recently he has shown that the embryos may be recovered from the blood of the ear vein of experimental animals by the use of this method (given below), though the number of parasites is much less than in the heart blood. In seven guinea-pigs he found one to three parasites in the blood, in five of these, using only 0.05 to 0.3 c.c. of blood. He therefore believes that it is highly probable that in man the blood obtained from the finger or ear in cases of trichinosis may show the parasites, and thus excision of the muscle may be obviated. In filariasis the parasites are often present in such number that they are readily seen in preparation of fresh blood. Stäubli has had one case in whose blood this method gave negative results, but by diluting the blood with acetic acid and centrifugalizing he was able to demonstrate the filaria. He suggests the use of his method of examination in other conditions which, however, seem less promising. In using Stäubli's method only blood which flows freely should be used, and the pipette should first be washed out with 3 per cent. acetic acid. The apparatus must be carefully cleaned before using. The blood is then diluted with 10 to 15 volumes of the acid; 3 per cent. acetic is always strong enough to cause complete laking of the red cells, but weaker solutions were found to be unsatisfactory in some cases. So far as Stäubli has observed the acid is not injurious to the parasites. After centrifugalizing the sediment is examined fresh or smears are made and stained, preferably with Giemsa's or Jenner's stain.

Basophilic Granulation of the Erythrocytes in Embryos.—NAEGELI (*Folia Hæmatologica*, 1908, v, 525) has examined the blood of the embryos of the rabbit, guinea-pig, mouse, sheep, and pig, and in all of these he found basophilic granules in the red cells. He believes the same results would be found in the blood of human embryos if it were possible to examine the blood of embryos not still-born. In some of his specimens more than 70 per cent. of the red blood cells showed basophilic granules. The results in all instances were comparable. Very interesting findings were obtained from examining rabbit embryos of different ages. All specimens were stained with Giemsa's stain. (1) Embryos 0.7 to 0.8 cm. long. Practically all the cells are polychromatophilic megaloblasts, with relatively large well-preserved nuclei. There were many mitoses (monasters and diasters), always with basophilic granules in the protoplasm. (2) Embryos of 1.4 to 1.5 cm. Very many magaloblasts, both orthochromatic and slightly polychromatic were found, none, however, with basophilic granules. Ninety-five per cent. of these megaloblasts show small blue particles of nuclear material, usually three to five in number, often collected in small colonies, but occasionally isolated. Rarely these nuclear derivatives, when situated close to the nucleus, are stained deep red. The first generation of the blood cells (the large forms) lacks basophilic granules. The second (smaller) generation of erythrocytes even now predominates. Normoblasts are very frequent, always markedly polychromatophilic, and some cells contain a central red mass of chromatin, others many fine basophilic granules. In cells in which the polychromatophilia is less marked basophilic granules are fewer and coarser. Normoblasts in mitosis are always strongly polychromatophilic and show basophilic granules. (3) Embryos 2.2 cm. long. The blood of these embryos shows many rather large orthochromatic red cells, often with basophilic granules and frequently with a red chromatin particle centrally placed. The normocytes are the same as in the last group. (4) Embryos 5 cm. long. The majority of all cells are orthochromatic normocytes with basophilic granules. Often thse cells show a red nuclear particle centrally placed; frequently the nuclear particle is situated peripherally. In the latter arrangement, however, the basophilic granules are never found in the same cell. (5) Embryos 10 cm. long. The macrocytes are now lacking. Often one finds normocytes with centrally or peripherally placed nuclear particles. No cells are found which show basophilic granulation.

These results demonstrate conclusively the constant presence of basophilic granules in the blood of embryos. Whether the granules arise from the nucleus or the protoplasm, Naegeli is unwilling to state as yet. He describes and pictures three kinds of basophilic substances in red cells of embyros: (1) Red chromatin rests usually centrally placed, becoming gradually smaller with the increasing age of the embryo, may be found, especially shortly before birth. He has seen similar structures in pathological blood in man in cases of pernicious anemia, lead poisoning, and anemia pseudoleukemica. Not inrfequently such cells show basophilic granules as well. (2) At times one finds one to two peripheral nuclear particles in the red cells, and these have also been found in pernicious anemia, lead poisoning, anemia from hemorrhage, and chlorosis. They represent the last remnant of the nucleus, and are not found in early embryonal life. (3) Particles which are apparently

snared off from the nucleus are found only in macrocytes and megaloblasts. When situated near the nucleus they stain red, while those peripherally placed are usually blue. They are readily stained with all nuclear dyes, and are easily demonstrated with the triacid stain. There is no connection between these and basophilic granules.

With the demonstration of large numbers of cells showing basophilic granules in the blood of normal embryos of all animals examined, a new and very important argument is brought forward for the regenerative character of these granules.

The Blood in Basedow's Disease.—GORDON and VON JAGIE (*Wien. klin. Woch.*, 1908, xxi, 1589) have made complete blood examination in 13 cases of Basedow's disease, including 7 incomplete cases, which they called Basedowoid. Normal red and white counts and normal hemoglobin were found, though occasionally a slight leukopenia existed (3500). Differential counts showed in nearly all a relative lymphocytosis up to 39 per cent., and a relative mononucleosis up to 13.5 per cent. In all cases in which the percentage of lymphocytes was normal, there was a marked increase of the large mononuclears, and the reverse was also true. They emphasize especially the value of these findings in the incomplete cases. The mononucleosis is to be explained by the splenic enlargement, which is not uncommonly found in this disease. They refer to the enlargement of the lymph glands, and think that this has something to do with the lymphocytosis.

Arterial Pressure in Tabes, and its Modifications during the Gastric Crises and Lightning Pains.—J. HEITZ and M. NORERO (*Arch. d. maladies du cœur, des vaisseaux, et du sang*, 1908, i, 505) have studied the blood pressure in tabes, especially in relation to the gastric crises and lightning pains, and find that in the former there is generally a marked vasoconstriction and hypertension, most probably secondary to the pain. Pain is possibly due to an irritation of the posterior roots, and is accompanied by the reflex phenomena of vomiting, constipation, and the vasoconstrictor influence which brings about the hypertension. This increase of the pressure is absent in those cases in which the pain is slight or absent. The hypertension becomes less marked in the older patients, possibly because the reflexes are interfered with in the progress of the lesions. The peripheral lightning pains are also associated intimately with the hypertension. As regards treatment, the inhalation of nitrite of amyl relieves the pains immediately, and this may be kept up even after the pressure has returned to normal. Injections of nitrite of sodium, 4 centigrams (⅔ grain) daily, do not seem to have any influence on either the pains or the hypertension. The gastric crises are accompanied by an acceleration of the pulse contrary to those in lead poisoning and gallstone colic. From their observations Heitz and Norero do not think that the cardiovascular system of tabetics suffers from the repetition of the pains as much as one would think.

The Inhibition of Pancreatic Activity by Extracts of the Suprarenal and Pituitary Bodies.—RALPH PEMBERTON and J. E. SWEET (*Arch. Int. Med.*, 1908, i, 628) have found that the suprarenal glands and the nervous portion of the pituitary body in dogs contain something which,

on extraction with salt solution and intravenous injection into dogs, cuts short the flow of pancreatic juice after the administration of secretin. It also prevents the stimulation of the gland by secretin if such an injection has preceded. This feature has been found up to the present time in no other tissues. It is independent of the general rise in blood pressure seen after the intravenous injection of adrenalin and pituitary extracts. The inhibitory factor of extracts of the suprarenal gland seems to disappear by decomposition, oxidation, or other processes before the blood pressure raising element has gone. It would appear that the suprarenal and pituitary bodies have at least one property other than those generally recognized as present in them.

Rheumatic Myocarditis.—Carey Coombs (*Quar. Jour. Med.*, 1908, ii, 26) notes the importance of the involvement of the myocardium in patients who have had rheumatism, and thinks that so much attention has previously been focussed on the pericardium and endocardium in rheumatic subjects that the myocardium has been more or less overlooked. In his study, Coombs has reached the following conclusions: That dilatation of both ventricles is constant and often of considerable degree. The auriculoventricular orifices share in the stretching. Hypertrophy of both ventricles is usually present, and in many instances without any obvious mechanical cause. The changes in the heart are mainly microscopic, and consist of slight fatty changes in the cells, but the important point is the formation of nodules in the stroma. They appear to constitute an inflammatory reaction, and are characteristic of rheumatic, as opposed to other forms of carditis; similar changes are seen in rheumatic endocarditis, pericarditis, and subcutaneous rheumatic nodes. The toxemia accounts, no doubt, for the greater part of the fatty changes in the cells, as well as the dilatation and hypertrophy. Coombs thinks that the physical signs characterizing the rheumatic heart disease of childhood are, in the majority of cases, referable to the myocardial lesion and not to those of the serous layers. Death during childhood from rheumatic conditions is frequently directly due to myocarditis, while in later life also some deaths are due to this same cause.

Tabes a Disease of the Deep Sensations.—J. Grasset (*Scientific Series* 5, Montpelier, 1909) in this monograph presents a most thorough clinical study of the disturbances of the deep sensations in tabes, the various analgesias, the abolition of the deep reflexes, trophic changes, arthropathies, etc.; gives a thorough anatomical and physiological study of the disease; and notes the importance of the involvement of the sympathetic system. He concludes that tabes is a disease of the deep sensations, and that the disturbances of these play a more or less important role in each case; they are of such importance in its diagnosis that whether the picture be complete or not one cannot conceive of tabes without disturbance of the deep sensations, while no other group of symptoms is so indispensable in a picture of the disease. The disturbances of the deep sensations most commonly met with are the analgesias on deep pressure (epigastric, tracheal, testicular, ocular, tendons, bones, nerve trunks) or with disturbances of the stomach, heart, bones, and articulations and their consequences, hypotonia and the possibility of forced articular displacements, trophic disturbances, loss of tendon reflexes, loss of

muscle sense with its resulting ataxia. These are symptoms of a defect in the deep sensations, and the direct consequence of lesions in the posterior tracts. At the same time there are many other symptoms that become evident in a fully developed case of tabes which are more or less due to disturbances of the superficial sensations; it is impossible to picture a break in the working of the deeper sensations without the involvement of the superficial also. The disturbances of the deep sensations are, however, of more importance than the others and precede them.

Typhoid Meningitis.—E. E. SOUTHARD and E. F. RICHARDS (*Jour. Med. Research*, 1908, xix, 513) report the case of a man, aged thirty-two years, who died after an acute illness of one week. There was no history of previous typhoid fever. The patient had had lues at nineteen, gradually advancing tabes at twenty-eight, and the signs of general paresis at thirty. At autopsy the findings were those of a hypostatic pneumonia, acute cerebrospinal leptomeningitis, and enlargement of the mesenteric lymph nodes; there were no lesions corresponding to a typhoid infection in the intestine. A pure culture of Bacillus typhosus was obtained from the meningeal pus and the large mesenteric glands, but blood cultures failed to yield the same organism. The meningeal exudate contained polynuclear leukocytes in great numbers, suggesting the hypothesis that Bacillus typhosus in the meninges may exert a directly pyogenic action. Should this hypothesis be upheld the indications are that the typhoid bacillus may have two separate effects: the one produced by diffusible toxin characteristically in the intestinal tract, and the other produced in the meninges either by the direct local action of the bacilli or through an endotoxin due to destruction of the bacilli. Experimentally, Southard and Richards found that Bacillus typhosus inflamed the meninges of guinea-pigs, the exudates showing many polynuclear leukocytes, mononuclears appearing only about seven days after inoculation. Further research is desirable to determine whether the local action of Bacillus typhosus in the meninges is or is not of an endotoxic type.

Palliative Treatment of Elephantiasis.—ALDO CASTELLANI (*Philippine Jour. of Science*, 1908, iii, 311) has been experimenting for some time with injections of various antiseptics, with the idea of destroying the organism which causes this disease (such drugs as methylene blue, bichloride of mercury, carbolic acid, various arsenical compounds, cacodylate of sodium, quinine, and others). All of these were of little use. Then Castellani used theosinamin on account of its power of softening various kinds of fibrous tissue. As the injections of theosinamin are very painful Castellani used "fibrolysin," which is a water-soluble combination of theosinamin with sodium salicylate, 2 c.c. corresponding to 0.2 grams of theosinamin. This dose is given daily or every other day according to the case. At the same time rest, massage, and, most important of all, proper systemic pressure by means of bandages which are necessary adjuncts. Later surgical measures can be resorted to for the removal of the redundant skin. This method the authors found of great use in a certain number of suitable cases. As yet he has found no definite explanation for the action of theosinamin. It was noted, however, that in some cases following the injection there

was a fairly well-marked, though transient, leukocytosis. It is to be noted that the treatment without a constant well-distributed pressure on the affected parts by bandaging does not cause any marked improvement, and that vice versa the pressure alone without the theosinamin injections has practically no effect in the severe chronic cases.

The Treatment of Thyroidism by a Specific Cytotoxic Serum.—JOHN ROGERS and S. P. BEEBE (*Archives of Internal Medicine*, 1908, ii, 297), in their latest report on the use of a specific serum in cases of thyroidism, review their former work on the subject go especially into the nature of the serum, and conclude that the serum has a specific effect in neutralizing the toxic action of the thyroid secretion. As a therapeutic agent it gives results which cannot in many cases be obtained by any other medical means. Not all cases presenting symptoms of thyroidism can be treated successfully with serum, because not all cases are purely hypertrophic in origin. The rapid amelioration of symptoms in acute toxic cases similar in most respects to the well-accepted instances of neutralization of toxin by antitoxin, is a weighty argument in favor of believing the symptoms to be due to the toxic agents of hyperthyroidism. The beneficial effects of combined treatment (administration of both the antiserum and the pure thyroid proteid, $\frac{1}{50}$ grain of thyroid proteid thrice daily and the injection of 5 minims of the serum every fifth day), gives the best results, and indicates a dysthyroidism as well as a hyperthyroidism as a factor in the production of symptoms.

SURGERY.

UNDER THE CHARGE OF

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Concerning Changes in the Blood after Operations.—BOLOGNESI (*Zentrbl. f. Chir.*, 1908, xxxv, 1457) says that for some time investigations have been made in the surgical clinic in Modena concerning changes in the blood following operations. In recent years he found by experiments on animals that a change occurred in the protein substance of the blood serum, in infections by the pyogenes communis. He decided to investigate whether any noteworthy changes occurred in simple operations done under careful asepsis, where the microbes were not acting and no narcosis was employed. When in small dogs various operations were performed and the blood serum of the animals, taken at various periods (three to eight days) after the operation, was treated with a 1 to 2000 solution of salicylic acid, in the proportion of 10 to 50, and this was

compared with the blood serum from a similar non-operated animal, there was always found a large quantity of precipitate (globulin?) resulting from this reaction. The quantity was less the greater the time elapsing between the operation and the taking of the blood from the animal. When the time periods were the same the quantity of precipitate was greater in the few cases in which the healing of the operation occurred by secondary intention. Bolognesi calls attention to the fact that the increase in the opsonic index of the blood found after chloroform narcosis is lacking in a simple operation without narcosis. The quantity of the precipitate found after operation corresponds to the effect on the opsonic index. In those cases in which after operation microbic infection develops, and in those in which after narcosis the opsonic index is increased, the above-mentioned precipitate is abundant.

A Communication on Nerve Surgery, with a Preliminary Report on the Anatomical Healing of Nerve Wounds.—BARDENHEUER (*Deut. Ztschr. f. Chir.*, 1908, xcvl, 24) presents a very elaborate paper on this subject, covering 200 pages. He says that the neuron theory is fully established at the present time. Nerve defects are bridged over, in all probability, chiefly through the outgrowth of fibrillæ from the central stump, rarely through connection with another center by means of anastomosis formation. The nerve fibres convey the impulses, while the ganglion cells are the functional and trophic center for the nerve fibers. For the preservation of the function of the nerve, its continuity with the ganglion cell and its nourishment by the blood are necessary. In excisions the muscles should be shortened according to the bone defect, in order that they may be so put on the stretch that they contract on the first impulse of the will and the circulation be made active. When there exists a circular constriction of the nerves and bloodvessels from non-inflammatory cicatricial tissue, conduction is impeded, from deficient elements in the ganglion cells, secondary pressure atrophy of the perifibrillar tissue, or marked and continued pressure upon the nerve fibers. Lateral pressure is dangerous only when the nerve cannot escape the pressure, *i.e.*, when the pressure works concentrically upon it, and arrests the influence of the ganglion cell. Degeneration of the peripheral portion then follows. The pressure of inflammatory material and intravaginal blood and lymph collections may produce this effect. Nerve sutures are best introduced through the nerve itself, and should be of thin catgut. In old wounds the fibrillæ adhere to each other better side to side, in which position the sutures can be more correctly placed. These at times give a better prognosis than recent wounds. For complete return of nerve conduction in the peripheral course of the nerve, three to six weeks, often a month, is necessary. In central, thick nerves, one or several years may be necessary, or it may fail entirely. Exceptionally function may return in five to twenty days, in which case there probably remained a previous anastomosis between the peripheral stump and a neighboring nerve, or between the two nerve stumps. Clinically, healing appears to occur by first intention. Histologically, it is not proved, and its demonstration appears to be impossible. Transplantation of entire nerves or by nerve flaps from an intact or slightly paralyzed nerve often gives good results. It is always best to combine it with a corresponding transplantation of the tendons, a shortening

of the paralyzed muscles by suture, and a cutting of the sound muscles and tendons. For transplantation of nerves one should take a sound nerve or a flap from a sound nerve, the function of which is not important. For this reason the hypoglossal is to be preferred to the spinal accessory, or the obturator to the crural. Hypoglossal grafting never gave better results in old wounds than in recent paralysis. The posttraumatic and postinfectious limitation of joint movements and the disturbance of nerve conduction are due not only to the adhesions of muscles and tendons to each other and shortening of the capsule on the flexor side, but also to the adhesions between tendons and nerves, which causes a constriction of the latter as well as of the arteries by the connective tissue. Under these circumstances the muscles, tendons, and nerves should be loosened, and tenotomy on the side of the injury, with myorrhaphy on the opposite side of the joint, should be done. Ischemic contractures result from interference with the return in the veins from callous constriction and a resulting neuritis. The so-called narcosis paralysis and birth palsy are due to pressure of the head upon the main vessels, accompanied by mild or severe ischemic inflammation of the muscles. In small caliber wounds of the bone and tearing of an important nerve, the nerve should be exposed in from eight to fourteen days and nerve sutures introduced. In subcutaneous nerve injuries, with moderate and rapidly disappearing paralysis, the old method of treatment with electricity and gymnastics is indicated. In old traumatic paralysis, with node formation at the site of the lesion, the electrical examination must decide the treatment after exposure of the nerve. If there is no reaction on electrical irritation on all sides of the node, then the node should be excised and the cut ends sutured together. When the reaction is present, an incision should be made through the sheath of the nerve, the blood clot removed, and the nerve and nerve sheath sutured. The very rare recurrences after ganglion excision result from anastomosis formation. After neurectomy they are due to outgrowths from the central end of the nerve or to the anastomosis of a neighboring nerve. Recurrences after neurinsarkoklesis are very rare and are the results of faults in the operation. Occasionally after excisions of the elbow, hand, and knee, there occurs, without injury of a nerve or ischemic palsy from a tourniquet, an almost complete paralysis of all the muscles. These depend, chiefly, upon the too great shortening of the bones and the relatively too great length of the muscles. The nourishment of the nerves is interfered with by the resulting deficient circulation of the blood and lymph in the nerves due to faulty tension and action of the muscles and nerves and to the surrounding inflammation. In all the nerve pressure palsies, such as occur after luxations and contusions, operation is indicated, because without it often months and years will be necessary for a cure.

Œsophageal Sarcoma.—Von Hacker (*Mitt. a. d. Grenzgeb. d. Med. u. Chir.*, 1908, xc, 396) says that primary sarcoma of the œsophagus is very rare and may be regarded as a curiosity. Von Hacker reports two new cases and gives statistics of 19 cases collected from the literature. The first of his cases was a leiomyosarcoma, polypoid in shape, with its pedicle attached to the œsophageal wall, about 10 cm. below the bifurcation of the trachea. It filled up the markedly dilated œsophagus,

and hastened the death of the patient by interfering with the swallowing of food. In the second case the sarcoma was of the round and spindle cell variety, and was attached by a somewhat broader base, partly in the lower end of the pharynx and partly in the œsophagus. The first was discovered at autopsy, but the second was properly diagnosticated during life by microscopical examination of a piece excised through an œsophagoscope. This is the first case in which a positive diagnosis has been made during life. Only three cases of sarcoma of the hypopharynx were found in the literature. In both sarcoma and carcinoma of the œsophagus, except for lymphosarcoma, the greater number of cases begin between forty-one and seventy years of age. Sarcoma is relatively much more frequent in the male sex, and takes origin more frequently in the thoracic portion of the œsophagus than in the cervical. It may develop as a circumscribed, at times a polypoid tumor, or as a diffuse infiltration of the œsophageal wall. The clinical symptoms of sarcoma do not differ materially from those of carcinoma. Unfortunately, in most cases, the diagnosis has been made accidentally at autopsy, and a careful clinical history was not taken. All symptoms depending upon the stenosis of the œsophagus and upon the growth and destruction of the tumor may be very similar in both diseases. Invasion of the neighboring lymphatic glands was evident in Chapman's and one of von Hacker's cases, so that this is not distinctive of carcinoma. The examination of the œsophagus may give much information in many cases, and even a complete diagnosis. A sound may determine whether there is a circular obstruction of some other kind. It can also determine the nature of the resistance to the sound. Only by the œsophagoscope and the removal of a small piece for microscopical examination, can a positive diagnosis be made. The prognosis of many kinds of sarcoma appears to be more unfavorable than that of carcinoma. If the sarcoma is located in the cervical portion of the œsophagus and is distinctly circumscribed, operation is indicated. Baum, in a sarcoma of the hypopharynx, did a subhyoid pharyngotomy and ligated the base, which was left in place. Recovery followed, but the further course of the case is unknown. Von Hacker did a resection of the œsophagus, with the formation of an œsophagostomy. In a short time an inoperable recurrence followed. In more favorable forms of sarcoma this operation may be more successful.

Trans-Abdominal Suture of the Left Ureter upon a Ureteral Sound; Healing by First Intention.—Boari (*Ann. d. mal. d. org. gén. urin.*, 1908, ii, 1761) says that we should bear in mind that a sound ureter differs from a pathological one. Generally the pathological ureter is adherent and immovable. Boari in doing a total abdominal hysterectomy for multiple fibromas, wounded the left ureter, to which the uterus was attached, at the termination of the operation. A No. 9 ureteral sound, conical and fenestrated, was introduced through a suitable opening in the ureter into the bladder. The other end was then passed into the central end of the ureter up to the kidney. The ends of the ureter were then united by a continuous circular suture of No. 3 catgut, without tension. The ureter was then replaced in the pelvis and covered by peritoneum and the abdominal incision closed. No trouble followed, and the woman did not complain of the presence of the sound in the

kidney or ureter. Separation of the urines from the two ureters by the Luy's apparatus was done on the third day, and it was found that the urine came only from the right ureter. The cystoscope showed that the end of the ureteral catheter in the left ureter projected about 3 cm. into the bladder, and was turned to the right, depositing its urine on that side. At the end of twelve days the sound was withdrawn with the aid of the cystoscope. The patient soon afterward went back to work, and about ten months after operation he was very well. Five months after operation a catheter was passed into the left ureter, but it detected no obstruction.

Concerning the Action of Prostatectomy upon Spermatogenesis and the Sexual Functions.—SUREDA, PEREARNAU, COMPAN, and BARTRINA (*Ann. d. mal. d. org. gén. urin.*, 1908, ii, 1766) say that recent researches on the physiology of the prostate have led some authors to consider that that organ has an internal secretion which exercises its influence upon the rest of the genital apparatus, and more especially upon spermatogenesis. The writers of this paper have studied this subject experimentally in dogs. Their work consisted of an anatomical study of the genital apparatus of the dog; an examination of the physiological condition of the spermatic secretion recovered from the vas deferens and from the epididymis; total extirpation of the prostate; observations of the sexual functions in the animals so treated; and examination of the sperm in them, before and after the injection of glycerin extract of the prostate. As a result of their studies they concluded that total prostatectomy in the dog does not suppress erections in them, nor the balanopreputial secretions; and that it is not demonstrated that the internal secretion of the prostate has a preponderating action on spermatogenesis.

A New Case of Madelung's Disease.—MARSAN (*Arch. gén. d. chir.*, 1908, ii, 472) says that Madelung has described under the name of spontaneous luxation of the wrist, a relaxation of the articulation, which is produced slowly and is aggravated little by little without any traumatism or any inflammatory lesion. Madelung has been shown to have been in error, in that there is no luxation, but a diaphyseal or epiphyseal incurvation of the radius. The disease is, therefore, a curved radius. The radio-carpal connection remains normal. Marsan reports a case in which the radial curve existed on both sides, much more marked on the left than on the right. The deformity had its origin a year before, and during the same time there developed a tubercular arthritis of the left tibiotarsal joint with fistula, which has been cured. The patient entered the hospital for a right coxalgia, which kept him in bed for six weeks. All these disturbances have followed pseudo-rheumatic articular pains, which have lasted a year and have presented their maximum intensity at the wrists. In a *resume*, Marsan says that his patient is tuberculous, and that the tuberculosis is of the articular form. The skiagram shows that the lesions occur only at the inferior diaphyso-epiphyseal junction. After the pseudorheumatismal beginning, the tubercular lesions localized themselves at the left tibio-tarsal articulation and the right hip. Then, simultaneously, there developed a double radial curve at the wrists.

Extirpation of a Popliteal Arteriovenous Aneurysm.—STICH (*Deut. Ztschr. f. Chir.*, 1908, xcv, 577) reports the following case, in which the divided vessels were united end-to-end by circular suture: A boy, aged sixteen years, received a piece of cold iron in the left thigh. He lost much blood, but the wound healed quickly, and he went to work after eight days. In a short time the left limb was much larger than normal. An elastic stocking was worn without results. A year after the injury Trendelenburg's operation for varicose veins was performed, again without improvement. About five months later he was again operated on. The swelling and the disability were much greater. Besides a very thick and elastic œdema, there was visible in the whole leg and up to the junction of the middle and upper thirds of the thigh a cord like vein, dilated to the thickness of the finger. This pulsated distinctly, especially in the region of the knee; its walls were thickened and nodular, as in varicose veins. No pulsation could be felt in the dorsalis pedis and anterior tibial arteries. Over the popliteal region a considerable bruit could be heard on auscultation. The dilated vein was freely exposed just above the knee, and the wound was deepened into the popliteal space which contained a pulsating tumor, which was shown to be a sacculated, lateral dilatation of the popliteal artery. It communicated with the vein and gave to it a strong pulsation. The vein was torn during the operation and was ligated above and below the communication, so that a 4 cm. long piece of the vein could be resected. The arterial aneurysm was so inconveniently placed on the joint side of the artery that a plastic operation for the closure of the opening in the artery could not be carried out. The opened specimen showed that a double lateral suture of the artery and of the vein would have been necessary, and a troublesome stenosis would have resulted. After the application of clamps to the artery, a 1 cm. long piece was removed, which contained the communication with the artery. The two ends of the artery were brought together by slightly bending the knee; and were united by a circular suture with much less difficulty than is frequently the case in the smaller arteries of the lower animals. Immediately after the operation the toes of the left foot were of a normal color and the sensibility well preserved. Five months after operation the patient felt tension in the limb only after long walking. Fourteen days after the operation he went back to his work as a blacksmith. There is distinct pulsation in the left dorsalis pedis and anterior tibial arteries.

An Experimental Contribution to the Question of the Collateral Circulation of the Kidney.—FLORCKEN (*Deut. Ztschr. f. Chir.*, 1908, xc, 591) carried out some animal experiments to show the advantages in collateral circulation of the kidney from connecting the omentum with the kidney after decapsulation. Martini, Parlavecchio, Omi, and Girgolaff came to the conclusion from their experiments that this operation produced a collateral circulation so free that it entirely or partly replaced the blood supply coming through the hilum of the kidney. Omi and Parlavecchio claimed that a better result was obtained from splitting the kidney and implanting the omentum into the cleft. Flörcken did his experiments usually in two sittings. In the first he did a transperitoneal nephrotomy and omentum implantation. In the second he

ligated the renal artery or the artery and vein, to disconnect as much as possible the kidney from the aorta or the aorta and cava. Some of the operations were done on both sides, some on one side. He concluded from his work that the double nephrotomy with implantation of the omentum in one sitting will usually not be borne by cats, the animals generally dying in a short time with uremic symptoms. After a unilateral nephrotomy with implantation of the omentum, the arterial anastomosis formed between the kidney and omentum was not sufficiently free to support the kidney after ligation of the renal vessels at the hilum. When the renal artery or artery and vein are ligated, necrosis of the kidney results. Whether the artery or both vessels were ligated the end results were the same. No efforts were made to investigate the venous collateral circulation.

THERAPEUTICS.

UNDER THE CHARGE OF

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The Curative Influence of Extracts of Leukocytes upon Infections in Animals.—Hiss (*Jour. Med. Research.*, 1908, xix, 323) in the introduction, discusses some facts and hypotheses of immunity and gives reasons to support the idea that leukocytes play an important part in the protection against infections. This protective power is most marked in those infections in which the poisoning is supposed to be due to endotoxins. In these infections there is most need for a direct action of the leukocytes upon the invading microörganisms and their poison, Ordinarily this action occurs in the body of the leukocyte and forms a part of the phenomenon of phagocytosis. Hiss assumes that the leukocytes manufacture some substance or substances—(digestive) poison-neutralizing or complementary—which prevent the destruction or injury of the leukocytes during phagocytosis. These substances exist in the individual cells and are not ordinarily given off into the blood stream. Hiss, from this hypothesis, conceived the idea that these substances might be extracted from the leukocytes and artifically introduced into infected animals or man. Such substances, if they became free from the cells by extraction might aid the leukocytes in their fight against infection by furnishing them as directly as possible with the active substances. The leukocyte, then, would be enabled to recuperate and would be better protected against destruction. This idea of immunity assumes the presence and production in the leukocytes of agents which are not normally given up to the plasma, and are for the benefit and protection of the individual cell. These agents are only of benefit to the body when the leukocytes containing them exist in sufficient numbers to intervene successfully between the invading germs

and their products and the cells requiring protection. If these substances are introduced artificially in an available form, they might neutralize poisons in the blood and thus accelerate the work of the body leukocytes. Hiss used rabbits for most of the experiments; occasionally dogs and guinea-pigs were used. He speaks of the possible variations in the protective power of the leukocytes of different animal species. The leukocytes were obtained by double pleural inoculations with aleuronat. The resulting exudate was centrifuged and the serum decanted. The cells were either directly subjected to the extracting fluid or after washing with normal saline solution. The extracts were obtained by thoroughly emulsifying the cells in distilled water and allowing them to stand for a few hours at 37.5° C., and then at ice-box temperature until used. The resulting extract is shaken up before injection since there is often considerable cell residue which may contain some of the active substances. Dog leukocytes seem to go into solution very readily, while rabbit leukocytes are not materially changed morphologically. A very brief general summary of Hiss' detailed experimental evidence only is possible, but the evidence certainly seems to justify the belief that extracts of leukocytes furnish some means of combating infections. Animals suffering from severe septicemias and poisonings following intravenous injections of such organisms as staphylococci, streptococci, pneumococci, meningococci, and typhoid bacilli showed marked resistance after the leukocyte injections, when compared with the controls. In many instances they survived injections fatal to the control animals in thirty-six hours even when the treatment was delayed for twenty-four hours. The animals treated often showed a marked fall in temperature corresponding to the injections. The beneficial effect of the extracts was often seen in a diminution of the loss in weight or a rapid return to a normal weight. Animals thus treated often seem, for a time, much sicker than the controls. This is especially true in typhoid and meningococcus infected animals, and also occurs to some extent in cases of pneumococcic infection. Hiss thinks that this result may be due to an increased bacteriolysis and the consequent liberation of endotoxins, thus suggesting the presence of complementing bodies, or of digestive substances peculiar to the leukocytes. The immediate effect on the temperature and the rapid improvement in body weight give a strong impression that the principal substance at work is an antitoxin.

Hiss' conclusions are as follows: Extracts of leukocytes from normal rabbits have a distinct modifying and curative action when given subcutaneously or intraperitoneally to rabbits, even in systemic infections which are rapidly fatal in untreated rabbits. Rabbit leukocyte extracts are also similarly useful in infections of guinea-pigs. Extracts of leukocytes from immunized animals seem, in some instances at least, to have even greater curative effects than extracts from leukocytes of normal animals. The action of the leukocyte extract may be due to an increase of the bacteriolytic action of the animal's plasma by the introduction of complement or to the action of digestive substances usually not liberated from the leukocyte, but is most likely due to poison-neutralizing or destroying bodies which act on the endotoxins. These bodies he denotes by the term *endo-antitoxin*. Hiss finally says that it does not seem unlikely that extracts of leukocytes (polymorphonuclear and

mononuclear) and possibly of the blood forming organs furnish us with means of combating infections incited by those microörganisms generally looked upon as giving rise to endotoxin poisonings and which have steadily refused to yield to the action of immune sera alone.

The Curative Influence of Extracts of Leukocytes upon Infections in Man.—Hiss and Zinsser (*Jour. Med. Research*, 1908, xix, 429) supplement the experimental work on animals with some observations upon the value of such extracts in the treatment of human disease. The extracts used were aqueous extracts of rabbit leukocytes, which were injected subcutaneously. Local reactions were slight, and lasted at most for a few hours. This treatment was carried on in twenty-four cases of epidemic cerebrospinal meningitis. Two of these cases were discharged against advice before the outcome of the disease could be foretold. Although they were apparently improved, they are not included in this report. Of the remaining 24 cases, 14 were discharged cured and 8 died. Fifteen of these 22 cases were under fifteen years of age, and of these 15, but three died, giving 80 per cent. of recoveries. Of the remaining 7 cases over fifteen years of age, 5 died. This may be due to the fact that several of these adult cases were in a moribund condition when admitted to the hospital. Some of these fatal cases in adults showed marked improvement under treatment, living twenty-seven, seven, thirty-eight, eleven, and twenty-five days after treatment was begun. They state that, of course, statistical studies of such a small number of cases is of little intrinsic value, but that their observations in the individual cases pointed very strongly to the beneficial effect of the leukocyte extract. Immediate improvement occurred after the injection of the leukocyte extract no less in some of the fatal cases than in those recovered. Such changes seemed more marked after the first injection than after later ones. There was an almost invariable improvement in those symptoms which depend upon the central nervous system, such as vomiting, delirium, stupor, and hyperesthesia. This improvement was so prompt that it seemed to exclude any anatomical changes, and, therefore, they believe these symptoms are due to the toxemia. A marked reduction in the temperature was usually caused by the injection. This reduction was often only temporary, and they believe that this is further evidence of an antitoxic action of the extract. A reduction of the leukocytosis occurred as the toxic symptoms lessened, and in some of the cases the spinal fluid became less turbid. They also treated seven cases of lobar pneumonia, and, although drawing no definite conclusions, they believe that further clinical tests may be of definite therapeutic value. In pneumonia there was an almost invariable drop in the temperature following a single injection of the extract. The antitoxic action is thus again suggested. The improvement in the subjective symptoms, the limitation of the lesions, and the increase in the number of leukocytes in some of the cases are additional factors which seem to indicate a more efficient operation of the natural agents of protection.

The Effect of Injected Leukocytes upon the Development of Tuberculous Lesions.—Opie (*Jour. Exper. Med.*, 1908, iii, 419) says that when tubercle bacilli are injected into the pleural cavities of dogs, the

result is an almost certain fatal general tuberculosis. The process begins first in the mediastinum and rapidly extends to the lungs, liver, and kidneys. Opie found that this result could be delayed and in isolated cases cured by the intrapleural injection of a sterile purulent exudate. This sterile exudate is obtained by the intrapleural injections of turpentine in healthy dogs.

Typhoid Toxin Obtained by Means of Lecithin and its Immunizing Action.—Bassenge (*Deut. med. Woch.*, 1908, xxix, 1257) supplements some observations previously reported. In the earlier observations Bassenge found that a 1 per cent. emulsion of lecithin in sterile distilled water had the property of dissolving typhoid bacilli. If this emulsion was introduced into the peritoneal cavity of guinea-pigs, the animals would be protected against subsequent intraperitoneal inoculation of typhoid bacilli, provided that a period of twenty-four hours had elapsed between the injections. In the present paper he confirms these results. He compared Merck's ovolecithin, brain lecithin, plant lecithin, and agfa-ovolecithin. A 1 per cent. emulsion seemed to be the maximum strength obtainable. To 20 c.c. of the lecithin emulsion, two loopfuls of a twenty-hour broth culture were added. In all of the experiments, all traces of living bacilli disappeared within twenty-four hours. Old ovolecithin seemed to have an almost instantaneous bacteriolytic action. 1 c.c. of the emulsion killed one-third of the animals, while 2 c.c. killed all. By regulating the dose of the emulsion, guinea-pigs were so immunized that they resisted twenty times the lethal dose of virulent typhoid bacilli. This result was obtained when an interval of from twenty to twenty-four hours between the injections was allowed to elapse. The control guinea-pigs died in from seven to nine hours. This immunity persisted as long as thirty-eight days. Bassenge concludes that lecithin is capable of setting typhoid toxins free in sufficient quantities to produce powerful antibodies when the emulsions are introduced for the purpose of immunization. He suggests that the lecithin emulsions may be of value in the treatment of typhoid fever in man. The lecithin may be removed from the emulsion by shaking the emulsion with chloroform and filtering through a Pukal filter.

Restriction of Fluids in Nephritis.—Strauss (*Berl. klin. Woch.*, 1908, xxi, 998) does not reject the opinions of Oertel and of von Noorden that large amounts of fluid increase the work of the heart in cases of cardiac insufficiency due to cardiac disease. However, he believes that other equally important factors exist in cases of cardiac insufficiency due to disease of the kidneys. He thinks that an increased amount of fluid is necessary for the removal of the poisonous substances and that their removal will more quickly lighten the work of the heart. He could not determine an increase of the blood pressure when large quantities of fluid were used. His observations on the urine and blood serum and certain animal experiments did show a diminution in the excretion of the poisonous products of metabolism when the amount of fluid was diminished. He, therefore, thinks it absolutely necessary to increase the amount of the fluids, even if an overburdening of the heart is a result. Rest in bed and digitalis should be used to combat this tendency to cardiac weakness. If the heart weakness is marked, Strauss

advocates moderate amounts of fluid given in small frequent portions at fixed intervals. Strauss also believes that anasarca in nephritis is a compensatory measure, since the fluid may dilute the retained poisons. If increased fluids are given, the anasarca will disappear in many cases. On the other hand, the anasarca may increase, and then the removal of the fluid by aspiration results in the withdrawal of both fluid and poisonous bodies. If uremic symptoms occur Strauss increases the amount of fluid. Slow, rectal irrigations are of great service (drop method of Wernitz), though he warns of the possible damage to the kidneys from the use of sodium chloride solution.

The Serum Treatment of Chronic Nephritis.—CASPER and ENGEL (*Berl. med. Woch.*, 1908, xli, 1836) give an account of eleven cases of chronic nephritis treated with serum which they obtained in the following manner: 50 to 60 c.c. of blood was withdrawn by venesection from a given case of nephritis. This blood furnished 25 to 30 c.c. of serum which, after warming to 58° C., was injected in healthy dogs. The dogs were injected once or twice a week in gradually increasing doses until eight or ten injections had been given. The dogs were then bled and the serum obtained. This serum was injected in small doses in cases of nephritis until, after repeated injections, no constitutional reaction occurred. Then normal human serum and even at times normal animal serum was injected for the purpose of supplying the complement. Their findings were as follows: (1) The treatment is harmless. (2) In some cases the amount of albumin and the number of casts in the urine remained the same; in others, they diminished and even entirely disappeared. (3) In all the cases, the general condition was benefited. (4) The œdema disappeared. They believe that the serum has no effect on the kidney tissue already diseased, but that it may prevent the extension of the process. They explain in this way the apparent absence of effect upon the amount of the albumin and number of the casts in some of the cases in which the other symptoms improved.

The Action of Arsenic on the Red Blood Corpuscles and a Theory of the Blood Defect in Pernicious Anemia.—GUNN (*Brit. Med. Jour.*, 1908, 2481, 145) draws the conclusions from his experiments that arsenious acid forms a fixed combination with red blood cells and acts as a protective agent against hemolytic agencies. His experiments were concerned with the hemolytic action of distilled water. The protective action of arsenic was perceptible when the experimental solution was as weak as one in 400,000 The ordinary maximum dose of arsenic is 0.005 gram, and if this was all absorbed, the amount of arsenic in the blood would be one in a million. However, arsenic is frequently given in larger doses in the organic combinations, and it is very slowly eliminated. Furthermore, arsenic seems to attach itself so rapidly and so firmly to the red blood cells that it is probable that the drug is largely taken up by them. Therefore, he believes that arsenic is of benefit in pernicious anemia because it prevents the destruction of the red blood cells. He also believes that arsenic protects the red blood cells from invasion by the malarial parasite, but that it does not destroy the parasite. His theory of pernicious anemia is not an entirely new one. He thinks

that the defect is not in the hemoglobin, but in the stroma of the red blood cells; that the stroma has a deficiency of lecithin and cholesterin; that the lack of rouleaux formation of the red blood cells in pernicious anemia points to a deficiency of fats; that these lipoid substances are lecithin and cholesterin; and that the poikilocytosis and irregular staining characteristics are additional reasons for assuming such a deficiency. On the basis of this theory, the beneficial effects of extracts of bone marrow may be explained, for bone marrow is rich in lecithin and cholesterin.

PEDIATRICS.

UNDER THE CHARGE OF
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Present Knowledge of Whooping-cough.—H. H. DONNELLY (*Archives of Pediatrics*, 1908, xxv, 819) writes concerning whooping-cough as follows: The mortality from whooping-cough is exceeded only by that from typhoid fever and from diphtheria, all other epidemic diseases having fewer fatalities. In 1906 there were 6324 deaths due to it, 96 per cent. occurring in children. Of every 37 deaths occurring in children in 1906, one was due to whooping-cough. It is chiefly a disease of early childhood; premature infants may contract it, 20 per cent. of the cases occurring in infants less than a year old, while 66 per cent. occur in children under five. The ratio of girls and boys is 6 to 5. It occurs more frequently during raw and inclement weather. An organism indistinguishable from the influenza bacillus has been isolated from the sputum by a number of observers. The serum of whooping-cough cases produces marked agglutination of these bacilli in dilutions of 1 to 200 to 500. Deaths in whooping-cough are usually due to its complications (bronchopneumonia, tuberculosis, emphysema, cardiac disease, cerebral hemorrhage). Tracheobronchial catarrh is constant in these cases. The contagion persists throughout its entire course, and is especially marked in its early stage. The contagion is usually direct. The period of incubation is unknown. The clinical symptoms are readily recognized, when the disease is well developed; during the early stage the child complains of lassitude, headache, disturbed sleep, catarrh of the upper air passages, cough; slight fever may be present. Blood examination shows an increased leukocyte count with lymphocytosis. Puffiness and bloating of the face are marked between paroxysms; they are due to venous and lymphatic stasis. A few rales before the paroxysm, followed by signs of emphysema afterward are the only chest signs present in an uncomplicated case. There is an increase of uric acid secretion. The average duration is from eight to twelve weeks. The complications are chiefly due to the mechanical effects of the cough, the extent of the infection, and the lowering of the general tone rendering other infections possible. The treatment in-

cludes attention to hygiene, ventilation, clothing, and diet. A rational fresh air treatment should be carried out; an abdominal belt made of linen relieves vomiting and lessens the paroxysm. Local antiseptics should be used; of drugs, quinine and antipyrine have more advocates than others.

A New Treatment for Old Tuberculous Sinuses.—J. RIDLON and W. BLANCHARD (*Amer. Jour. Orth. Surg.*, 1908, vi, 13) treated 26 children having old tuberculous sinuses with Beck's bismuth-vaselin paste. A paste made up of 2 parts of vaselin to 1 part of bismuth was injected and a skiagram taken showing the ramifications of the sinuses. This injection was usually expelled within twenty-four hours. Then a paste made up of 6 parts of bismuth subnitrate, 1 part of white wax, 1 part of soft paraffin, and 12 parts of vaselin (mixed while boiling) was injected into the fistulous opening until it would hold no more without painful distention; all or part of it was usually retained. The paste must be at blood heat at the time of injection. The amount discharged into the dressing was re-injected every two to three days. Favorable cases retain the bismuth, the opening healing over in from one to three weeks. In cases with extensive bone destruction several sinuses are usually injected from two to three times weekly, the pus then escaping from the others. If the pus disappears within a few weeks, assurance may be given that months of persistent treatment will cure the sinuses. If the pockets are so situated that the bismuth cannot be forced in to displace the pus, the results will always be negative. Ridlon and Blanchard ascribe the curative action to the bismuth acting in a mechanical way. The pus is forced out by the plug, which then so completely fills the sinus, as to prevent the ingress of air-carrying germs; lastly it compresses the unhealthy granulating surfaces, a normal healing process naturally resulting. Of the 26 cases, 6 were cured with a single injection, 7 with from two to fifteen injections, 7 were improved, 1 unchanged, and 5 are still under treatment.

A Contribution to the Study of Tuberculin in Orthopedic Practice.—C. OGILVY (*Amer. Jour. Orth. Surg.*, 1908, vi, 35) employed tuberculin according to Calmette's ophthalmotuberculin test in 40 children from the standpoint of diagnosis; in 30 the reaction was positive, in 10 negative. Of the latter, 9 were non-tuberculous. The negative reaction in cases known to be tuberculous has been claimed by some to be due to a condition of low resistance—low opsonic index as occurs in the negative phase; this is probably the case in the tenth instance, which was one of known tuberculous hip-joint disease. Six patients were treated with injections of tuberculin, and the following conclusions were drawn from the observations by Ogilvy: By means of the opsonic index we have learned the importance of small doses of tuberculin, and the time at which they should be administered. But this having been learned, it is by no means necessary, nor is it practical, to follow up the treatment with control indices. For the diagnosis of tuberculous bone and joint disease the opsonic index is of little practical value. Tuberculin in small doses at proper intervals is of undoubted value in the treatment of selected cases of tuberculous bone and joint infections. The rise of the opsonic index is accompanied by an improvement in the local and

general conditions of the patient, if no secondary infection exists. While there are discharging sinuses and mixed infections, the opsonic index may be raised by the use of tuberculin without an accompanying improvement of the general or local condition. The opsonic index will prove of value in determining the advisability of discontinuing mechanical treatment. It is also of value in determining the prognosis in tuberculous bone and joint disease.

Tumors of the Breast in Childhood.—J. H. JOPSON, J. SPEESE, and C. Y. WHITE (*Annals of Surgery*, 1908, xlviii, 662) report 2 cases of benign mammary tumors in children, give a review of the literature on the subject of mammary tumors in childhood, and formulate the following conclusions from their studies of the subject: Tumors of the breast, while rare in childhood, occur in both sexes and at all ages. The benign tumors are more frequently encountered in the mammary gland in early life than the malignant tumors. The fibro-epithelial growths are the most numerous group of the benign tumors, and next to these in point of frequency come the angiomas. Sarcoma may occur in children in the mammary gland, but it is a rare tumor. The breast enjoys almost complete immunity to carcinoma before the age of puberty. Girls are affected more frequently than boys, but the disparity in numbers is immensely less than in adults. The angiomas are commonly congenital, or first appear in infancy. The fibro-adenomas tend to develop more frequently as the child approaches puberty. Some of the smaller benign tumors occasion no inconvenience. Others are associated with symptoms of pain, tenderness, and inconvenience or discomfort from excessive weight or size. Sarcomas present the symptoms common to that type of tumor. Operation is usually indicated in the benign and always in the malignant varieties. In small benign tumors, or those involving only limited areas, conservative plastic operations with preservation of the breast and nipple are indicated. In a goodly number, however, the breast must be sacrificed. The axilla should be cleaned if it contains enlarged glands. The results of operation are good.

Purpuric Hemorrhages following a Blow upon the Kidney Region.—E. LENOBLE (*Arch. des mal. du cœur*, etc., 1908, i, 475) relates the case of a boy, aged sixteen years, who had fallen a distance of 2 meters during play, striking his back. Pain over the kidneys developed, but not sufficient to force him to stay in bed until the tenth day, when he began to vomit and developed an intense diarrhœa. He bled from the nose and gums, and numerous petechiæ appeared over arms and legs. On the fifteenth day he voided bloody urine. The flanks were dull, the abdomen distended and tympanitic. Rectal examination showed a mass behind the bladder. Four weeks later a second purpuric eruption appeared all over the body. The urine was still bloody, and an ascitic accumulation was noted within the abdominal cavity. The red corpuscles were reduced to 3,200,000; there were 334,000 hemoblasts; the blood did not clot nearly as readily as normally, and numerous myelocytes were present. Complete recovery ultimately resulted.

OBSTETRICS.

UNDER THE CHARGE OF

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The Significance of Hemolytic Streptococci in Puerperal Infection.—HEYNEMANN (*Archiv f. Gyn.*, 1908, lxxxvi, Heft 1) reports his investigations regarding the significance of hemolytic streptococci in cases of puerperal infection. He examined the blood and lochial discharge from 125 puerperal patients who had fever. Among these were 22 in whom hemolytic streptococci were found; 4 died. In these patients the streptococci were found in the blood in abundance, and large doses of antistreptococcic serum were of no avail. In 2 patients thrombophlebitis of the pelvic veins was present, accompanied by severe chills. In both these cases the bacteria were obtained in pure culture from the uterine secretion. In one case Friedländer's encapsulated bacillus was found, and in another case Staphylococcus aureus. Both of these patients recovered. Among the 18 in whom hemolytic streptococci were found in the lochial secretion but not in the blood, there was no death, although the patients were severely ill. These cases were characterized by sudden rise of temperature to 104°F., with pulse of 126 to 140. This temperature subsided after a few days and these patients had no anemia, and the heart was practically normal throughout the illness. They were treated by absolute rest in bed, an ice bag placed over the lower abdomen, and the administration of ergotin. Various observers have found streptococci frequently in the lochial secretion from the uterus and vagina, and the presence of these germs in the genital tract is not an indication of fatal infection. In cases in which they are present there is a greater tendency to thrombophlebitis and parametritis. In some of these patients the colon bacillus was also found. In 2 of these cases the children became infected, and pure cultures of the streptococci were found in the stump of the umbilical cord. One of these mothers had a leg ulcer, which suppurated, and the other had a parametritic abscess. It is important to recognize the presence of hemolytic streptococci in puerperal infection, because it makes the diagnosis of infection certain. It also gives a reliable ground for prognosis, as the presence of these germs in the blood indicates that the patient is fatally ill. As regards treatment, one must abstain from disturbance by local treatment in these patients, lest absorption into the blood current be increased. The germs may be obtained from the genital tract by placing the patient upon her back in bed, separating the labia, and obtaining the lochial secretion by a sterile platinum loop, or sterile cotton, from the anterior portion of the vulva and vagina. The blood agar culture material is then infected with this secretion by stroking. In from seven to eight hours colonies of bacteria are visible, and in from nine to ten hours the growth is clearly recognizable. It is well to wait for ten to twelve hours after the cultures are started before examining the culture media to recognize the different forms of bacteria.

In six and one-half hours after infection chains of hemolytic streptococci can be seen. Clinical histories of 30 cases, with bacteriological examinations, are appended.

Spontaneous Labor in Contracted Pelves.—LEISEWITZ (*Archiv f. Gyn.*, 1908, lxxxvi, Heft 1) contributes from the Dresden clinic an interesting paper comparing the results of spontaneous birth in contracted pelves with those of various forms of pelvic delivery. He considers the pelvis as somewhat contracted in which the internal true conjugate is 10 cm., and the external from 18 to 18.5 cm. In 15,338 labors there were 6865 contracted pelves, 44.6 per cent. In some of these cases abortion or placenta prævia, or an abnormally small child, made the contracted pelvis of no importance as a factor in delivery. Among primiparæ 86.9 per cent. had spontaneous births; among multiparæ 81.1 per cent., making a general average for multiparæ and primiparæ of 84.1 per cent. of spontaneous births in contracted pelves. The percentage of labors requiring operation, in both multiparæ and primiparæ, was 18.8. When the morbidity and mortality of spontaneous and operative deliveries are contrasted, it is found that in spontaneous births there is a morbidity of 11.1 per cent. and a mortality of 0.3 per cent. in primiparæ, while from operation, morbidity was 20.3 per cent. and mortality 2.9 per cent. In multiparæ morbidity was 6.6 per cent., mortality 0.3 per cent. in spontaneous births; with operation, morbidity was 13.5 per cent., mortality 1.4 per cent. In the case of the children the morbidity and mortality were greatly increased by necessity for operation; thus, in spontaneous births mortality and morbidity was less than 2 per cent. in multiparæ and in primiparæ, while in operative cases it rose to from 21 to 22 per cent. The highest mortality and morbidity for mothers and children were in the flat rachitic pelvis, then in the commonly contracted flat rachitic, then in the flat pelvis, and lowest in the symmetrically contracted pelvis. So far as the choice of operation went, perforation was performed in 9.7 per cent. in primiparæ, 22.6 per cent. in multiparæ. Version and extraction gave a mortality of 23.5 per cent. for the children, and a mortality of 1.1 per cent. for the mothers, with a morbidity of 6.4 per cent. This method of treatment, so long a favorite one in Continental clinics, is infinitely more dangerous for the children than other and more recent operations. In induced labor the maternal mortality was 1.1 per cent., mortality for the children 29.4 per cent. In calling attention to the low mortality of spontaneous births, the statement is made that in clinics spontaneous births should not be despaired of for from twenty-four to thirty hours after the beginning of labor. In private practice the maternal mortality of perforation is a very high one, whose statistics are difficult to obtain. As regards hebostomy and Cesarean section, they are successful in proportion as patients are early seen and promptly transported to the hospital. In view of the frequency of spontaneous birth in contracted pelves, and its low mortality and morbidity, every effort should be made to bring it about, especially in cases which must be delivered in private houses.

Thrombosis and Early Getting-up in the Puerperal Period.—FROMME *Zentrlbl. f. Gyn.*, 1909, No. 1) believes that cases of thrombosis after operation and labor are more the result of infection than of early get-

ting up. He cites the case of a primipara, who during labor had ten vaginal examinations, made with gloved hands by midwives, assistants, and students. The patient was allowed to get up for one hour the day following her confinement; fever developed, and the patient died ten days after labor, with symptoms of pulmonary embolism. At autopsy an embolus was found in the pulmonary vessel, with thrombosis of the left spermatic vein and the veins of the left parametrium. In these thrombi streptococci were found; cultures were negative. Fromme believes that early getting up after confinement may dislodge thrombi which otherwise would become sterile and do no harm. During the last six years in the Halle Clinic, in 6600 cases of labor, no case of puerperal embolism has been observed.

HOFMEIER (*ibid.*) has examined the records of 10,000 puerperal women, finding 12 cases of thrombosis; 9 of these had severe complicated labors, followed by fever. In 3 cases the thrombosis was slight, and the puerperal period without fever. One of these was popliteal thrombosis, another epigastric; another developed in the varices in the lower portion of the thigh. Embolism did not occur, nor fatal result, in any of these cases of thrombosis. The conclusion is drawn that the method so long employed of giving patients rest in bed after labor, while it may not always prevent thrombosis, does, in the majority of cases, prevent embolism.

Cesarean Section with Twins and Placenta Prævia.—JARDINE (*Jour. Obst. and Gyn. Brit. Empire*, December, 1908) reports the case of a primipara with a generally contracted and flattened pelvis, on whom Cesarean section was successfully done in 1907. About two years afterward she was again admitted to the hospital with twin pregnancy, within two weeks of full time. Upon vaginal examination the edge of the placenta could be felt, but the patient had lost no blood nor was bleeding present. In view of the pelvic contraction, the twin pregnancy, and the situation of the placenta, she was delivered by Cesarean section. Incision was made in the line of the first, and the membranes, although ruptured previously, were tough and were torn through from above with some difficulty. The children weighed five and one-quarter pounds each, the placenta weighing one and one-quarter pounds. The operation proceeded without hemorrhage, mother and children making normal recoveries. The lochial discharge was a little more profuse than normal for the first few hours after delivery.

The Disinfection of the Hands with Acetone Alcohol.—OERI (*Ztschr. f. Geb. u. Gyn.*, 1908, lxiii, Heft 3) has experimented with von Herff's method of disinfecting the hands with acetone alcohol in the clinic at Basle. It is thought that the combination of acetone enables the mixture to be used on all portions of the body, and attacks the fatty tissue and disinfects it more thoroughly than alcohol alone. The use of the nail brush may be omitted, which is a great advantage. The hands are more thoroughly sterilized and in a shorter space of time than by other methods. A longer disinfection is obtained by this method. The use of soda solution for ten minutes increases the efficiency of the method somewhat. A prolonged operation without gloves does not especially increase the number of germs present. As the method is a simple one, it is especially adapted for the use of nurses and midwives. In the

clinic the alcohol employed was 95 per cent., and the proportion of acetone, after some experiment, was fixed at 10 per cent. The most efficient combination, however, seemed to be that of 50 per cent. alcohol and 50 per cent. acetone. Preliminary cleansing with soap, water, and brush was omitted. The action of the mixture on the hands seemed to harden the skin, and the hands were rubbed with sterile flannel dipped in the solution, when the redness and irritation seemed to disappear. Four minutes were occupied in disinfection. This method did not seem to irritate the skin, and one of the staff, who suffered from eczema, excited by other methods of disinfection, was much improved by this method. Bacteriological experiments showed the method to be efficient.

In direct contrast to this, in the same clinic, is Pfisterer's paper (*Ztschr. f. Geb. u. Gyn.*, 1908, lxiii, Heft 3), in which alcohol alone was used as a disinfectant. This showed that alcohol was efficient for a short time only, for operations not exceeding five minutes in length.

The Opsonic Index in Puerperal Infection.—HEYNEMANN and BARTH (*Ztschr. f. Geb. u. Gyn.*, 1908, lxiii, Heft 2) publish the results of studies of the opsonic index in various forms of puerperal infection. They find the opsonic index of the serum of puerperal patients free from fever, does not act upon the hemolytic streptococci in the proportion given by Wright, namely, 0.8 to 1.2; in proportions of 0.7 to 1.3 an effect is noticed which has to be explained in part through previous infection with streptococci. A normal streptococcus relation in a puerperal patient having fever does not render impossible the former infection; the variation in this relation would suggest it, but not conclusively. The value of diagnosis by this method is then limited and applicable to a few cases only. So far as prognosis is concerned, the estimation of the opsonic index is of no value. In some cases of parametritis, with local and long-continued infection, this method may be of value as indicating the success of the treatment. The same facts are practically true in cases of staphylococcic infection.

GYNECOLOGY.

UNDER THE CHARGE OF

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Primary Cancer of the Body of the Uterus.—BALLARD (*Surg., Gyn., and Obst.*, 1908, vii, 460) reports a case of primary cancer of the uterus in which rupture had occurred. His conclusions in the case are as follows: (1) That an early diagnosis was not made from any symptom coming from the malignant area, but rather from the sudden hemorrhage through the perforation is clearly apparent; (2) that metastasis does not occur so frequently from the carcinoma of the fundus uteri as from the cervix is markedly noticeable; (3) that malignant growths of the

body of the uterus are of much slower growth and have much less pronounced symptoms than those of the cervix is certainly proved by the cases reported; (4) that the diagnosis of early malignancy in the fundus uteri may be prevented because of the want of symptoms is evident; (5) that having made an early diagnosis we can, by complete extirpation of the uterus and adnexa, promise a very favorable prognosis.

Immediate vs. Deferred Operation for Intra-abdominal Hemorrhage due to Tubal Pregnancy.—KRUG (*Surg., Gyn., and Obst.*, 1908, vii, 473), for the purpose of discussing the above question, divides all cases of ectopic pregnancy into five principal classes: (1) Unruptured. (2) Ruptured, in which the symptoms of shock and hemorrhage are slight. (3) Ruptured, in which trauma superinduces acute hemorrhage and in which the ectopic gestation is only a contributive condition. (4) Ruptured, in which the symptoms of shock and hemorrhage are grave. (5) Ruptured: ambulance cases brought to hospitals. In the first and second divisions Krug advocates prompt laparotomy. In the third class, such as those subjected to curettage for a supposed incomplete abortion and by traction on the cervix fresh internal hemorrhage is caused, Krug advises immediate laparatomy. In the fourth class he advises careful observation watching the temperature and counting the pulse every fifteen minutes. If general improvement occurs, delay operation until the patient can better withstand a laparotomy. In the fifth class the hemorrhage has usually ceased when the patient is admitted to the hospital, and expectant treatment for one to four days and then the performance of abdominal section is advised. Krug never uses intravenous infusion of salt solution until near the close of the operation. During the past four years he has operated on nearly 100 cases of ruptured tubal pregnancy with 2 deaths. One of these was from ether pneumonia and one from sepsis existing prior to admission.

Ovarian Pregnancy Co-existing with Intra-uterine Pregnancy.—KERR (*Jour. Obst. and Gyn., Brit. Empire*, 1908, xiv, 149) adds another to the very few reported cases of ovarian pregnancy. The ovary containing the ovarian pregnancy was removed by operation. The embryo was at a stage closely corresponding to one described by Graf. v. Spec. It was so much injured, however, that reconstruction was not possible, and the sections were exhibited to demonstrate the nature of embedding in the ovary, the ovum being the youngest yet recorded in that position. There was a large corpus luteum, the contour of which was intact, except at one point where there was young organizing connective tissue forming a continuous strand reaching from the centre of the corpus luteum to the margin of the inplantation cavity. The cavity has been excavated in the ovarian stroma, and its walls are formed, in part, of connective tissue in a state of coagulation necrosis, but to a greater extent by fibrin and blood clot. The surface of the ovary has been ruptured, and the ovum was evidently in the process of extrusion. There were absolutely no signs of any formation akin to decidua, and the more actively destructive phases demonstrated in the first specimen had obviously persisted until a considerable part of the ovary had been destroyed. The ovum lay more or less free in the implantation cavity, the villi were irregular, and many were overtaken by degenerative

changes, but they contained bloodvessels and showed precisely the same coverings as a uterine ovum at the same stage of development. The sections prove: (1) That the ovum can be embedded in the ovarian stroma outside the Graafian follicle. (2) That it embeds itself just as does the ovum in the uterus in connective tissue rich in bloodvessels. (3) As has already been shown by C. V. Tussenbroeck and others, the uterine epithelium is not necessary for plasmodial formation; as this ovum lies in the ovarian stroma neither can the plasodium be derived from the follicular epithelium. The two cases combined once again demonstrate the nature of implantation. The process involved is essentially a destructive one; the primary necessity for the ovum is a nidus of connective tissue rich in bloodvessels. Formation of decidua is not essential; it is a defensive reaction against the destructive activities of the trophoblast, which it limits and controls.

Pressure Conditions within the Abdomen.—SMITH (*Amer. Jour. Obst.*, 1908, lviii, 242), who has conducted experiments to increase our knowledge of pressure conditions within the abdomen, concludes: (1) Atmosphere pressure within and without the abdomen is almost exactly balanced, any variations at any point being caused by factors to be enumerated. There is no special universal positive pressure which has so frequently been assumed. Physiological increase or decrease of volume is attended by insignificant or no changes in pressure—the balance is practically maintained. A marked increase of volume from pathological conditions often takes place without disturbing the balance; this varies in different subjects. (2) Hydrostatic pressure at any point within the abdomen varies with the position of the body and the depth of the superimposed organs. (3) Negative pressure at uppermost points is possible under certain conditions where the walls of such uppermost points are rigid. In the upper abdomen in the upright position a negative pressure may exist, which has more or less to do with the support of the viscera. (4) Respiration causes small waves of pressure. (5) Coughing, sneezing, defecation, labor, and many movements of the body cause a very marked increase of intra-abdominal pressure by contraction of the muscles of the abdominal walls. Such pressure is transmitted in all directions and without diminution to every part of the contents and interior of the abdomen.

OTOLOGY.

UNDER THE CHARGE OF

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The Relation of Chronic Progressive Labyrinthine Deafness to Ménière's Disease.—ALEXANDER and MANASSE (*Ztschr. f. Ohrenheilk.*, 1908, lv, p. 183). Under the heading, Menière's disease, are commonly

included certain labyrinthine symptoms, when they occur suddenly and are of an apoplectiform character, and these are found, according to the observations of Alexander and Manasse, in the greater majority in cases in which there has been a disease of the ear of long standing evidencing itself in chronic progressive labyrinthine deafness. In this paper Alexander and Manasse cite eleven cases of patients who for several years had exhibited, on one or both sides, evidences of this chronic impairment of hearing of an advanced type, and who suddenly became the subjects of the typical Menière's complex of symptoms, increased tinnitus, dizziness, nausea, vomiting, and increased impairment of hearing, the attacks with this sequence of symptoms being subsequently repeated. In some of the cases there were marked changes in the middle ear, considerable retraction of the drumhead, and calcareous deposits, but in all cases the symptoms, as determined especially by the hearing tests, pointed to the labyrinth as having been implicated in the progressive impairment of hearing. The labyrinthine changes in these cases, as observed by Alexander, Bruehl, and Manasse, included atrophic degenerative changes in the nervous elements and new connective-tissue formations. In addition to these commonly observed changes Manasse found, in two cases, multiple hemorrhages in the course of the auditory nerve and in the labyrinth, and in one case numerous hemorrhages in the ligamentum spirale, a lesser number in the modiolus, an extensive number in the macula saccule, and congeries of hemorrhages in the nerve itself. The Menière sequence of symptoms in this case was undoubtedly the result of these numerous hemorrhages; more exact evidence was furnished by a second case of chronic progressive labyrinthine deafness, which had been under clinical observation and which came to autopsy but a few days after an attack characterized by Menière's complex.

From these observations Alexander and Manasse draw the following conclusions: (1) That in cases of nervous deafness attacks demonstrating Menière's complex of symptoms are comparatively common; (2) that in cases of degenerative labyrinth atrophy multiple hemorrhages in the labyrinth and in the auditory nerve are to be expected; and (3) that the access of these attacks is referable to the hemorrhages in question.

HYGIENE AND PUBLIC HEALTH.

UNDER THE CHARGE OF

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Endotoxins.—At the July, 1908, meeting of the German Society of Microbiology (*Centralblt. f. Bak.*, October 27, 1908) the so-called endotoxins and their relation to the true toxins were discussed, and the discussion developed considerable difference of opinion. Pfeiffer lead the discussion and quite properly claimed that his research on the cholera poison was the first work that quite clearly indicates that the bacterial

cellular substance contains a poison. Pfeiffer holds that the poison is firmly bound in the bacterial cell; it cannot be extracted except by deep-reaching chemical changes; it is not a secretion in any proper sense, and it is not set free nor can it injuriously affect the animal until the bacterium not only ceases to live, but is broken down, and its component parts pass into the solution. Pfeiffer states that he has never held that the endotoxins may not possess antigenic properties; but he has stated and still holds that in cholera and typhoid fever there is no evidence that an antitoxin is or can be produced. There may be found antibodies, but not in conformity with the theory of Ehrlich. He has not gone so far as some of his stuednts have, as to assert that anti-endotoxins may not be found, but if ever found they will most probably be quite different from the antitoxins already known, such as those of diphtheria and tetanus. There is a distinct difference between anti-infectious and antitoxic sera, and the therapy of the future will probably be more greatly benefited by improvements in the former than by discoveries of the latter. The dead cells of cholera bacilli are distinctly poisonous to man and experimental animals. This has been demonstrated beyond any question, notwithstanding its early denial by Gruber. The same is true of the cellular substance of the typhoid bacillus, and Friedberger has shown that the intravenous injection of only one-twenty-fifth of a milligram of the dead tpyhoid bacillus may cause most marked and prolonged toxic symptoms. However, the toxicity of the pathogenic bacteria is widely variable. Along with exquisitely toxic species are those that are relatively harmless; moreover, the susceptibility of animals to the endotoxins is also widely variable. Ransom and Metchnikoff found a poisonous body in old bouillon cultures of the cholera bacillus, and attempted to produce an antitoxin with it, but it is worthy of note that this poison does not appear in recognizable quantity until the culture has grown old and the bacilli undergo autolytic changes. Indeed, as Hahn has shown, fresh cultures of this bacillus are free from poison, consequently there seems to be no justification in holding or even suspecting that the cholera poison is a secretion. So long as the cell is growing and multiplying it forms no poison. The poison is not a secretion; it is a product of the dissolution of the cell. It is true that some atypical cholera strains, such as that of El Tor, produce an extracellular poison, but this is not true of typical cholera bacilli. Such a poison is not found either in tube cultures or in the peritoneal fluid of animals dead from the effects of these bacteria. Moreover, the poison that does result from the autolysis of old cultures varies in some properties at least, according to the stage in the decay and disintegration of the cells when it is examined. This is easily understood since it is more than probable that the primary products of autolysis undergo farther cleavage as time progresses. There have been several reports of the finding of soluble poisons in typhoid cultures, but in all of these the culture is old, and the poison is supposed to result from autolysis; besides such poisons are not highly active and by no means camparable with the toxin elaborated by the diphtheria bacillus. The same is true of the dysentery bacillus; even one-twentieth of a milligram of the dead cellular substance may kill a rabbit when injected intravenously, while Conradi found that 15 c.c. of the filtrate from cultures of from seven to thirty days old were without effect. It is true that Todd and Rosenthal obtained from filtered cultures of the dysentery bacillus,

from twenty to thirty days old, a filtrate 0.1 c.c. of which killed rabbits when injected intravenously, but it should be remembered that growth stopped in these cultures at five days, at which time the filtrate showed no toxic action; therefore, the most reasonable conclusions is that the poison found in solution in such cultures from fifteen to twenty-five days later results from cellular autolysis. If the poison were a secretion it should appear while the bacteria are still alive and multiplying. It is hardly conceivable that dead or even inactive bacteria pour out secretions. Secretions are products of life processes. It is possible that some varieties of the dysentery bacillus elaborate soluble poisons, but these are the exceptions and not the rule; besides, the toxicity of the cell substance is always many times that of the filtered culture. Cholera, typhoid fever, and dysentery are infections and not intoxications.

Pfeiffer describes MacFayden's method of extracting the endotoxins, and quite properly rejects it as costly, uncertain, and by no means convincing. It will be remembered that MacFayden froze his typhoid bacilli at the temperature of liquid air, powdered them, and then extracted with 0.1 potassium hydroxide. The freezing probably gave him a fine powder and the dilute alkali extracted small quantities of the endotoxin. He might have omitted his costly freezing, and used a stronger alkali in proper menstruum, and then he would have secured a much more active poison. Boreger takes the bacteria from agar slants and suspends them in physiological salt solution. This is evaporated to dryness and finely rubbed in agate mortars, then this powder is diluted with water until the strength of physiological salt solution is again reached, then it is centrifuged, when it is found that the supernatant fluid is poisonous. By this means a fine suspension of the cellular substance is obtained, nothing more. Pfeiffer states that he has tested the so-called antitoxic cholera and typhoid sera of Kraus, but with only negative results. He concludes his part in this discussion as follows: (1) Endotoxins really exist and are important factors in the infections. The possibility of preparing anti-endotoxic sera is still an open question. (2) The soluble poisons found in certain old cultures are autolytic products and may have no concern in the disease processes. (3) There are other methods of obtaining poisonous bodies from bacterial cells. (4) Together with the endotoxins and their derivatives there are produced by some bacteria true toxins that are secretory products.

Kraus, Pfeiffer's most prominent opponent, replied and in concluding made the following statement: He believes that the cholera, typhoid, dysentery, pest, and meningitis organisms contain specific toxins which have antigenic properties, producing their specific antitoxins by which they are neutralized. These poisons can be obtained not only by extracting the bacterial cellular substance, but in the filtrates of bouillon cultures. Whether these poisons are secretions, as some authorities hold, or pass into solution from the disintegration of the cells, has not been determined, and should not be brought into the discussion because it is a matter of secondary importance, and its solution would not add much of value to what we know. The important thing is that the intracellular and the soluble poison are identical and produce antibodies and are neutralized by antitoxins. It is desirable that it be ascertained what the relation is between these toxins and the aggressins of Bail and the phenomena of anaphylaxis. Kraus thinks that the aggressins are poison-

ous and that the toxins are not concerned in the phenomena of anaphylaxis, both of which opinions are probably wrong.

Kolle and his students, one of whom, Heller, participated in the discussion, believe that the soluble and the intracellular toxin are different bodies, and this seems to be best warranted by the facts. Heller using Bacillus dysenteriæ of Shiga produced the specific symptoms and characteristic lesions of the disease in rabbits and mice by, (1) the filtrate from twenty-day cultures, (2) filtered washings from living cultures, and (3) the dead washed bacillus. Then he attempted to obtain antitoxic sera with each of those and succeeded, but he found the antitoxic serum obtained with the dead washed bacillus was much less active than the others, and moreover, that the other sera protected against the extract and filtrate better than against the dead bacillus. He concludes from this that the toxin and endotoxin are not the same, but that the dead washed bacillus still contains some of the true toxin.

It may be seen from the foregoing abstract that our German friends are divided into at least three groups in their ideas concerning the relation between the true or soluble toxins and the so-called endotoxins. Pfeiffer holds that some bacteria, among which are those of cholera, typhoid fever, and dysentery, elaborate no true toxins, but that their poisons are intracellular and when found in solution they result from cellular autolysis or disintegration, and that active anti-endotoxic sera have not been produced. Kraus holds that these same pathogenic bacteria, like those of diphtheria and tetanus, do elaborate true toxins with which specific antitoxic sera may be prepared, and he does not care whether we believe that these toxins are secretions of the living cells or result from the breaking up of the cellular substance. Kolle and his students hold that these same bacteria have both true toxins and endotoxins, and that antibodies to the former are not produced by nor do they neutralize the latter. All, however, seem to agree that the poison elaborated by each species of bacillus is specific. [The writer of this review holds that the true or soluble toxins, like those of diphtheria, tetanus, botulism, etc., are specific and produce specific antitoxic sera, but that the endotoxins of the cholera, typhoid, and tubercle bacilli are not specific, but that every true protein, whether it be bacterial, vegetable, or animal, contains a poisonous group which in its effects on animals is the same. The presence of a special protein in the blood of an animal develops a specific enzyme which splits up that special protein and liberates the poisonous group to the detriment of the health and possibly at the cost of the life of the host.—V. C. V.]

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PROGRESS OF MEDICAL SCIENCE.

MEDICINE.

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